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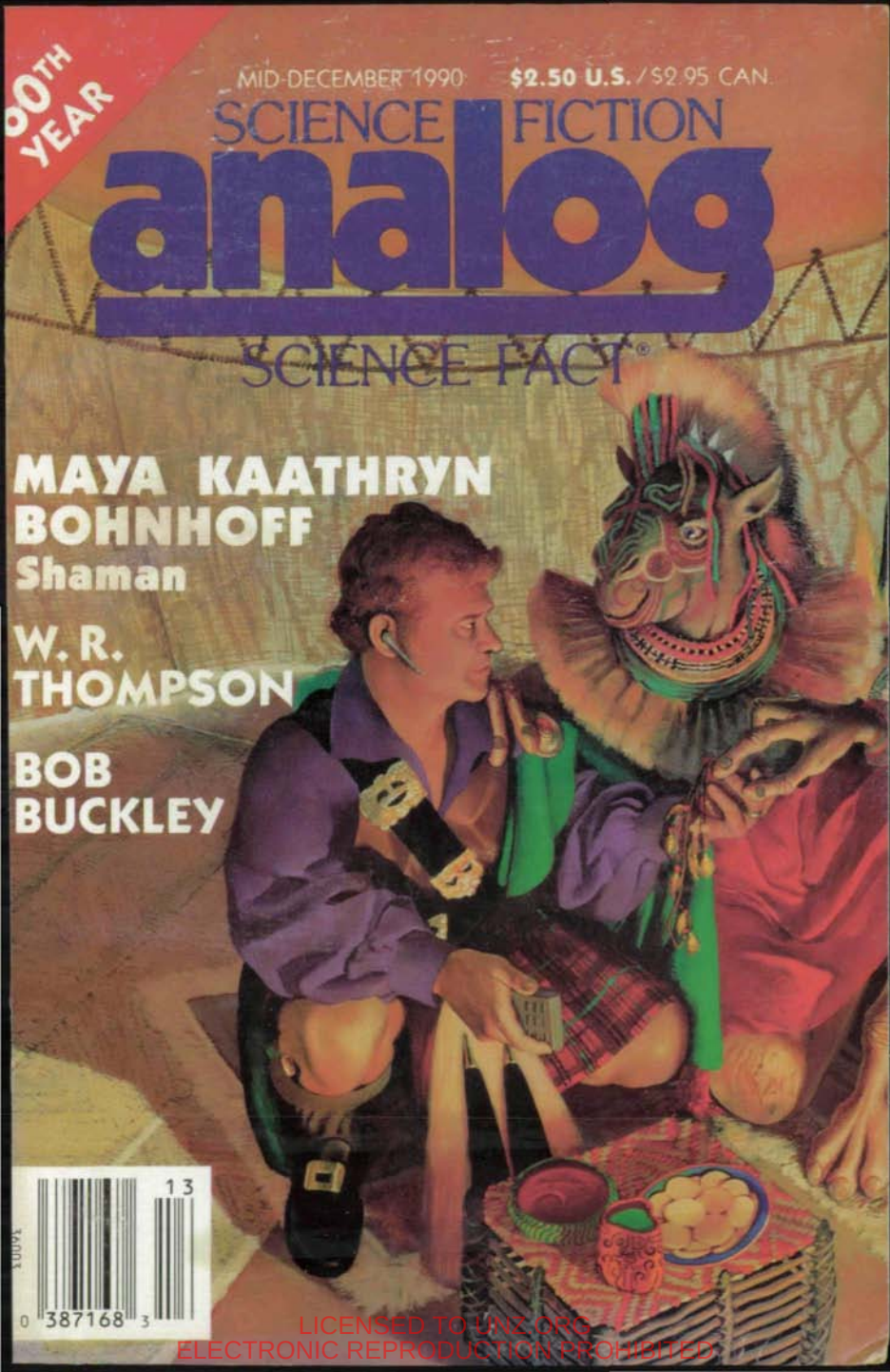

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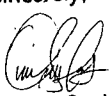

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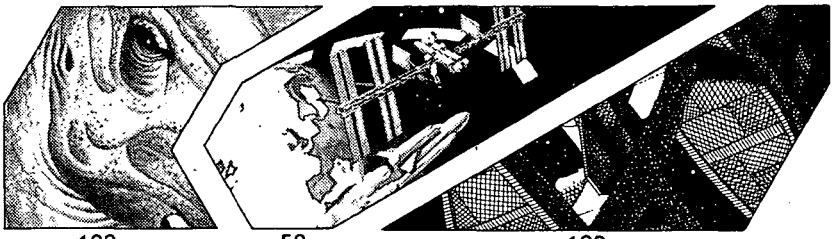

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Editorial

WINDOWS TO THE FUTURE

Stanley Schmidt

"The mistake you must never make about science fiction," Frederik Pohl once wrote, "is in thinking that, because it is about the future, it is necessarily about *the* future." Few, if any, science fiction writers have seriously believed that their job was to tell, accurately, what the future was really going to be like. The aim of science fiction is, rather, to imagine lots of ways the future *could* be, thereby letting readers "try on" a wide variety of possibilities to see which ones they'd like to strive toward or try to prevent. Since writers who do this well don't work blind—most of us try to keep abreast of what's happening in science and technology—it's hardly surprising that once in a while a reality comes along that looks quite a bit like a science-fictional "prediction." When that happens, it's understandable if those who had that vision in advance do a bit of gloating. You may be sure that a loud and exuberant chorus of "We told you so!" was heard in the land when the first man stepped onto the Moon.

But what constitutes an "accurate prediction"? Occasionally a story may depict something fairly close to the actual form of an invention, but it would be surprising if that happened very often. If a writer really knew *how* to build a matter transmitter, he'd probably do so rather than writing a story about it. Usually the main interest in a story lies not in the technical details of *how* something is done, but in what effect it has on people's lives. And it sometimes comes to pass that something very much like the *effect* described in science fiction turns out to be achieved by *means* quite different from the ones pos-

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tulated in a story. Sometimes, ironically, those means are far less exotic than their fictional counterpart, and so become reality much sooner than the fiction writer and his readers might have expected.

I have two recent examples in mind. One was called to my attention by my wife, a medical technologist, who handed me a copy of *Advance*, the weekly newsletter of her profession, and said, "I think you should take a look at page ten."

I did so, and found a two-page article titled "A Room With a View: Computerized 'Windows' Serve as Visual Healing Aid," by Dirk W. van der Vaart. A photograph showed a man looking out a window at a mountain lake under a sky full of puffy cumulus, but the caption said, "A construction supervisor at Stanford University Hospital inspects one of three artificial windows being installed in patient rooms to replace sunlight and outside view lost as a result of recent remodeling." Something eerily familiar began nibbling at the back of my mind as I settled down to read the article. . . .

It seems that when the Stanford University Medical Center remodeled its cardiac care unit last year, nobody realized until after the job was done —leaving three patient rooms windowless—that a federal regulation adopted in 1977 required all patient rooms to have either a window or a skylight. The new facilities would not be allowed to operate without them—but an ingenious way around the problem was found. The remodeling had made it impossible to provide *real* windows; but photographer Joey Fischer, originator of the Art Research institute in Woodland Hills, California, was able to provide a "reasonable facsimile" acceptable even to the Powers That Be.

A color transparency of a landscape, with the size and appearance of a window, was mounted on a light box on a wall—but not just any light box. This one contained lots of bulbs, of various colors, controlled by a computer program that changed the picture's lighting throughout the day. Overall intensity, color temperature, and distribution of light and shadow were continually adjusted to simulate the changing appearance of the real scene as the sun rose in the east, traveled across the sky, and set in the west. The transparency itself can be changed from time to time to simulate seasonal changes, as well; and at the time he was interviewed, Fischer was working on refinements that would include a normal night sky, complete with rising and setting moon.

The effect, according to even the earliest reports, was dramatic. A nine-year study by the University of Pennsylvania and the American Association for the Advancement of Science had already shown that patients with windows looking out on interesting scenes consistently recovered faster and needed less pain medication than those without them. Even static pictures helped somewhat, but lacked something crucial: the element of time. Patients in surroundings that provide no way to watch the passage of time become temporally disoriented. Watching a plaster or brick

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wall, or even a painting, does nothing about that, while watching trees does. So, apparently, do Fischer's "Windows of Nature." By providing a scene that undergoes daily and seasonal changes much like those in the outside world, they improve patients' morale and medical progress in the same way as the "interesting" windows in the Pennsylvania study.

And by now the thing that had been nibbling at the back of my mind was shouting loud and clear: "Slow glass!"

Remember Bob Shaw's short story, "Light of Other Days"? It's a gem, built on the postulate of a material called slow glass, with the peculiar property that light takes long periods—months, for instance—to pass through it. Slow glass "farmers" would leave panes of the stuff out for a year or so, facing a scenic vista and collecting light from it, and then sell them as "scenedows." Customers could hang them on walls, with the side originally facing the view now against the wall, and for the next

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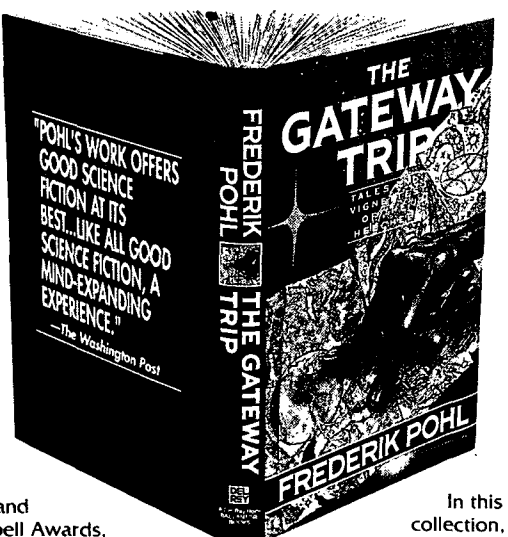
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year watch that scene go through its daily and seasonal paces as the collected light gradually emerged from the other side.

It's a lovely concept, but nobody has the slightest idea how to make *real* slow glass. Shaw's explanation requires stretching known science so far that it's doubtful that it can be done at all. But its important *effect* in his story was psychological: "Having a scenedow was the exact emotional equivalent of owning land." A few of you may recall that I have quibbled with that statement in the past, and I still don't believe it's the *exact* equivalent. But, compared to a blank wall in a hospital room, it's *awfully* close.

Joey Fischer's "Windows of Nature" look very much like Bob Shaw's "scenedows," and provide the same psychological benefits—with the result that they're spreading rapidly into other hospitals and industrial settings. (People *work* better in rooms with views, too.) But while Shaw's version depends on a discovery that will very likely never happen, and certainly can't be expected soon, its most important *effects* are being achieved with straightforward, off-the-shelf technology less than 25 years after he wrote the story!

My other example is an old standby of so many science fiction writers that it's hard to know who should get the principal credit for it. Vernor Vinge and William Gibson are perhaps the best known miners of this vein, but they weren't the first or the last. *Lots* of writers, for quite a while as this field goes, have played (and continue to play) with the idea of a direct interface between a human nervous system and a computer. The possibilities such a connection would open up are exceedingly wide-ranging, from ultrarealistic flight simulators, to the "direct" experience of environments in which a human body could not survive, to experiencing whole worlds that don't exist at all except in a computer's data banks and the mind of its programmer.

As John G. Gramer pointed out in his July "Alternate View," the technical problems of creating such a direct mind-computer interface are such that it looks quite unlikely that anybody will build one anytime soon. But, as he also pointed out, a *direct* connection is not the only kind possible, and researchers in various parts of the world are already experimenting with "telepresence" and "virtual reality" using much more "ordinary" methods. I don't know how many labs are doing this kind of work, but I've seen an impressive presentation by Dr. Thomas Furness of the Human Interface Technology Laboratory at the University of Washington, and I've read Grant Fjermedal's description of another in Japan. Abrams/Gentile Entertainment, Inc., reportedly plans to market a virtual reality *game*, for home use and for under $200, by 1992. Every account I've seen or heard from anyone who's tried one of these setups (I haven't had the chance myself, yet, but you can bet I'm going to take the first one I get!) describes the experience as unbelievably realistic.

It *feels*, in other words, very much like what science fiction writers have

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A WORD FROM Brian Thomsen

Well buckle my swash and shift my shape, it's great to get away from it all and enter a fantasy world. Just look at some of the advantages. Where else can thieves become kings or one can apprentice one's self to a sorcerer? (*The New York Yellow Pages* has five entries for Merlin but none are currently in the market for a learn-as-you-go assistant.) Where else can a nerd become a hero or a hacker a warrior? With the help of Williams or Simmons anything is possible.

When you see me around ask me for a mystery—I may recommend a whodunit with a narrator who happens to be both a computer and a killer.

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described for a direct link—but it gets that effect with a system using only such built-in human senses as sight, hearing, and touch. A helmet provides stereo pictures and sound; a glove senses hand position and pressure; a computer compensates for the wearer's motions. None of the existing systems do everything that might be imagined, but they clearly point the way to doing as much of it as anyone might want. The rest, along that way, is detail; while the direct interface remains a distant goal reachable, if at all, only by roads that haven't yet been built or even fully surveyed. Whether the direct interface will even prove *worth* reaching, or whether the sensory approach might provide the same benefits more easily, remains an open question. The direct link could turn out to be obsolete long before it's built!

And the question that occurs to me is: how many *other* science-fictional predictions will turn out to be similar? I've described two cases where science fiction has described a method which is wildly exotic from our present point of view—at least difficult, and perhaps even impossible, to achieve—to do something which people would find useful and desirable. In each case, real researchers have found a way to get the useful and desirable effects, or at least a fair approximation of them, using only well-established contemporary technology. In the real world, it turned out, they didn't *need* the exotic science-fictional mechanism to get the exotic science-fiction results.

So how many more surprises like that are lurking in the stories and labs of the world? How many more things that are "just science fiction" could we do now, or soon, in a relatively simple way that even the science fiction writers overlooked? ■

● Apply your mind in at least one problem which has never been solved, which in general is considered impossible of solution, but which, being solved, would help humanity. Do with your life something that has never been done, but which you feel needs doing.

Harvey H. Nininger
Submitted by Chet Twarog

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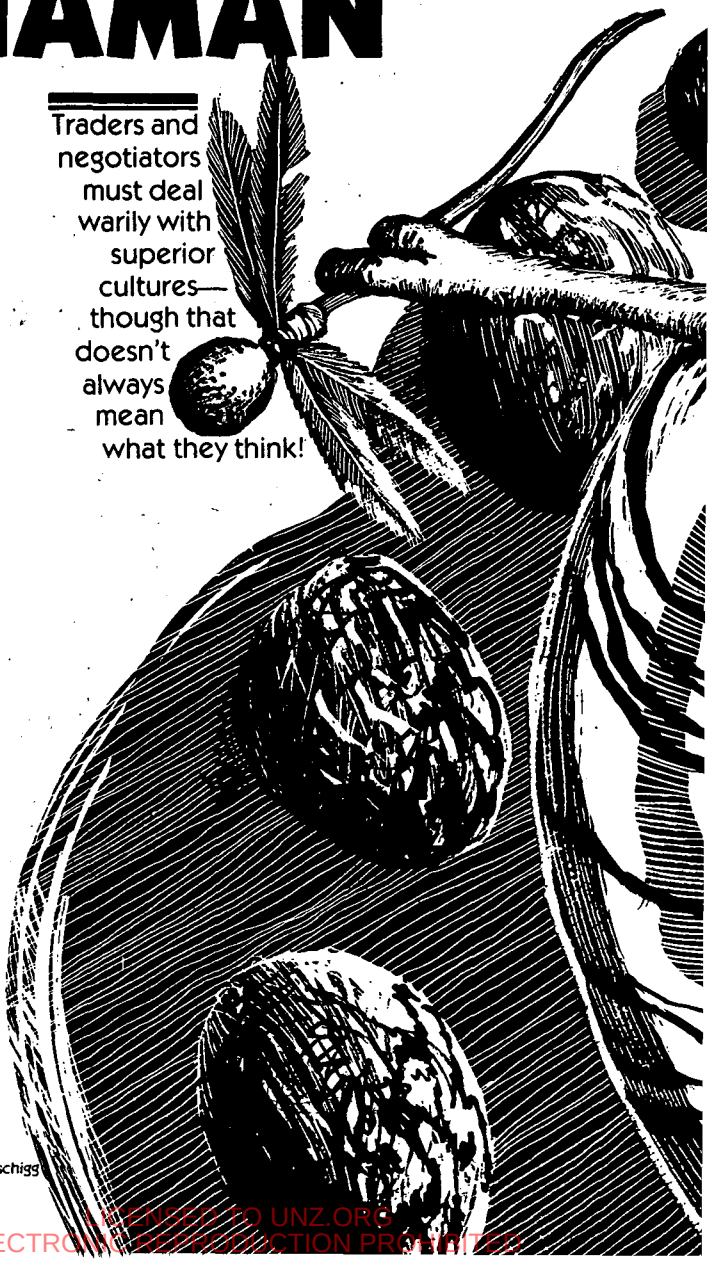
SHAMAN

Traders and negotiators must deal warily with superior cultures—though that doesn't always mean what they think!



Nicholas Jainschigg

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Rhys Llewellyn was both ecstatic and agitated when the surveys returned the information that the largest temperate land mass on the planet Pa-Loana was rich in something the natives called "foon." He was ecstatic because a rich source of foon, known on Earth and its colonies as "super-latex," was sure to revolutionize the manufacture of all manner of clothing, sports gear, space suits, medical supplies—in short, anything that required a durable, flexible, low-care material. He was also ecstatic because foon was so plentiful on Pa-Loana; a form of algae, it literally covered the face of the Pa-Loanian waters. Then, too, the natives inhabiting the largest temperate land mass of Pa-Loana (the Pa-Kai, by name) were friendly folk amenable to selling rights to exploit what, to them, was a nuisance that had to be strained out of their drinking water. This was cause for further ecstasy.

Rhys Llewellyn was agitated because he knew that the resource survey team had returned the same reports to Bristol-Benz and that right now, somewhere in their sumptuous corporate offices, their head contract negotiator was studying those reports and feeling both ecstatic and agitated.

From this point on, it would be a space race to determine who got their negotiating team into the tent of the Pa-Kai Tribal Council first. Rhys Llewellyn was determined that it would be Tanaka Enterprises. To that end, he and his two assistants arrived at the Tanaka Corporate Travel Park an hour and a half after the reports landed in his terminal.

They spent the bulk of the five-day TAS transit to Pa-Loana taking Sub-Learn courses in Pa-Kai language and etiquette, going over the environmental impact surveys and discussing strategies to use in case Bristol-Benz appeared on the scene before they had a firm deal. Unfortunately, this last measure turned out to be necessary. Rhys and company arrived at the Pa-Kai Council Tent just in time to join the council of chieftains and elders in greeting the Bristol-Benz negotiators.

The exchange between the Tanaka and Bristol representatives was barely cordial, a thing which the Pa-Kai Eldest noted immediately.

"You are enemies?" he asked Rhys in flutelike tones. His crest of sagittal hair shifted forward in a gesture Rhys knew indicated intense curiosity.

"No," Rhys assured him carefully, making the "Please do not think that!" face. "We are . . ." There was no word for competitors in Pa-Kai. "We are grazers of the same field."

The Eldest nodded sagaciously and herded the two parties of "grazers" into the huge tent. Inside, the negotiators were accorded side-by-side sets of cushions arranged as part of a gigantic circle. The remainder of the circle was occupied by the chieftains of the Pa-Kai Clans, while directly across from the human delegation was the raised pallet of the Eldest Chieftain.

Just before him on the ground, within a circle of stones, sat a character out of a childhood nightmare. Dressed in feathered and furred garb that made the garish robes of the chieftains look drab, the kneeling form sported a rainbow of

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cloth strips tied to its crest hair and an equally colorful pattern of ornate lines and symbols painted on its camellike face.

"Is that the court jester?" whispered Assistant Negotiator Roderick Halfax in Standard.

Rhys shook his head. "Shaman," he said.

"He's certainly . . . uh . . . bright."

"She," said Rhys. "And she holds a very important place in the Pa-Kai tribal heirarchy. Of all the clan shaman, she's considered to be the greatest. All others are her apprentices." He indicated the area behind the circle of chieftains where the Shaman and Elders from each of the nineteen Pa-Kai Clans sat to observe the proceedings.

When all had been seated, the Eldest took his place on the raised pallet. At his bidding, a fruit beverage was served, along with small edibles called tso-tso, one dipped in a creamy fruit pulp called gua. Following his lead, Rhys Llewellyn's two assistants dipped, ate, and drank the servings given to them on small woven platters, then nodded, smiled, and smacked their lips. The Pa-Kai did likewise and added to the proceedings murmurs of pleasure and musical chatter. Very quickly the entire assemblage was dipping, eating, smacking and chattering.

The only exception to this was the Bristol-Benz delegation, which ate and drank in relative silence, watching the rest of the crowd expressionlessly. After about twenty minutes of socializing, the head B-B negotiator set his speaking frond in the stand before his cushions and pointed his chin at the Eldest.

All chatter ceased abruptly. In her stone circle, the Pa-Kai Shaman executed three pirouettes and dropped to her knees staring up at the Eldest. She made a gesture at the B-B team with the tips of her three fingers, then sat cross-legged on the ground.

According to Rhys's understanding of Pa-Kai tribal ettiquette, the Bristol-Benz negotiation had just committed an act bordering on the impudent. He watched with interest, waiting to see the rewards of that impatience.

The Eldest pointed at the B-B representative and said, "Speak, please."

On his right, Rhys's second assistant, Yoshi Umeki, glanced at him with obvious concern. He shook his head very slightly and tapped his ear. She turned her attention to the Bristol negotiator as he rose and began to speak, hands folded across his flat stomach in a demure gesture reminiscent of a nineteenth-century priest.

"We have come to bargain, O Beauteous One," he said in deep, awesome tones. "You have a thing which is to you an itch, but which is to us a scratch."

Rhys nodded, impressed. He'd been pitted against Vladimir Zarber before and had to admire the man's aura of dignity. It had, he was forced to admit, lost him a few contracts. In fact, in a scored contest, he would have to allow that Zarber was ahead by a score of 6-2. It didn't help that he had that wonderful basso profundo vocal quality, or those elegant, understated gestures, or that rolling (and authentic) Oxford accent. Compared to that, Rhys Llewellyn's tenor with its airy Irish (also authentic), sounded downright wimpy.

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This, Rhys decided, could be a long, painful process.

It was the Pa-Kai Shaman who returned Zarber's opening. "We hear you, O Deep Voice," she replied, her voice a flute to his bassoon. "We have foon. It is said you . . . need foon?" This last was said with what passed in Pa-Kai as a stifled snicker. The Shaman followed this by shaking a stick topped with a cluster of bells and uttering several shrill notes before hunkering down to hear Zarber's reply.

"This is the truth," said the negotiator solemnly. "We need foon."

A ripple of musical Pa-Kai laughter washed about the tent.

"Pardon our grins," said the Shaman, "but we find it difficult to eat the need of foon."

Zarber blinked and seemed momentarily nonplussed. Rhys Llewellyn wondered if the Bristol-Benz reps had taken the time to study the Advanced Pa-Kai Dialect module of the Linguistic SubLearn package. Zarber's next comment indicated they had not.

"We don't intend to eat the foon," he said.

The Pa-Kai went into toots and twitters of mirth and the Shaman, her shoulders shaking with her own effort not to laugh, said, "We know you do not eat foon, O Humorous One. But what do you do with it?"

"We use foon to make another thing called super-latex. From this, we make many other things."

The Shaman seemed to find this as amusing as the idea of eating foon. "You use foon to make a thing to make another thing? Why not just make the thing?"

"We . . . used up the foon on our home world," returned Zarbere, lugubriously, making a face that said, "I am to be pitied." "Then we learned how to save it. We are letting our foon grow again, but we need so much super-latex, we must ask (pleadingly, his face said) for your excellent foon."

The Shaman had apparently never thought of foon as being excellent and stifled another display of mirth. "And you," she pointed her chin at Rhys. "You need foon too?"

"Yes," he said. "We are here to bargain for what you call foon."

"And you used up all your foon, also?" The Shaman's snout wrinkled with her effort not to laugh.

"We are children of the same home world," explained Rhys. "We represent two different . . . clans. His clan wants the foon—" he pointed with all four fingers at Zarber "—and our clan also wants it."

The Shaman's semi-circular eyebrows rose sharply, causing her forehead to wrinkle. "Clans? You are Shaman, then, are you? Which of these are your chiefs? Pardon our eyes, but your clothing is so young and dirty we cannot tell you apart."

Zarber gave his clothing a secret glance, then said importantly, "Our chief remains on our homeworld. He is handling other important business. We have come to speak for him."

There was almost a collective gasp from the assembled Pa-Kai. All eyes turned to the Eldest. He rose and all the chieftains rose with him. Without a word, they filed silently out of the tent. Zarber gaped.

Rhys Llewellyn shook his head. While

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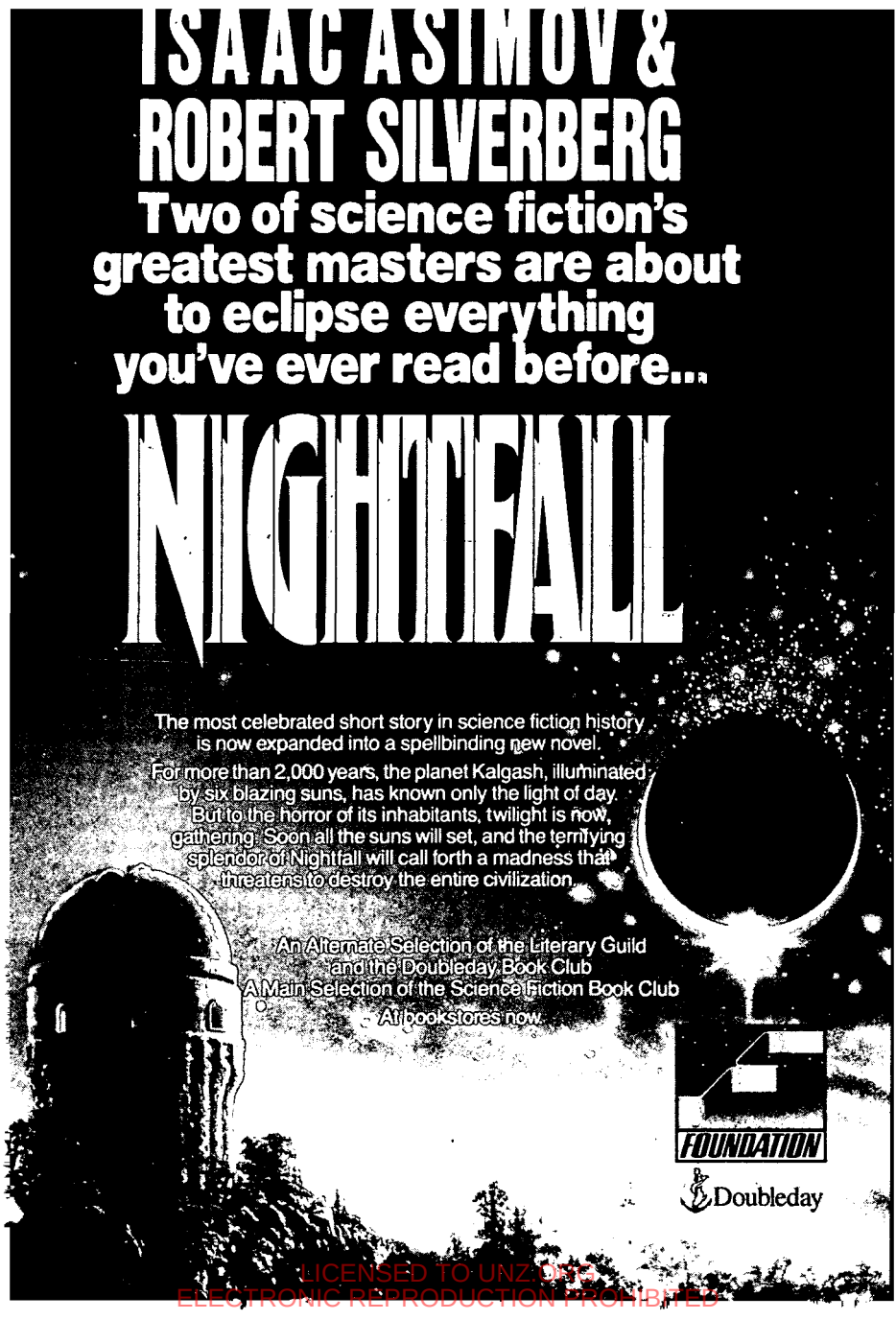

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the lingual lessons had been relatively thorough, the ettiquette sections had obviously left some serious gaps. He'd have to remedy that when this was over, but right now he prayed that notes on business etiquette were not all he came out of this with.

The Shaman had risen and jutted her chin at them. "Chiefs must be present," she said.

"But our chief is on another world," objected Zarber with injured dignity. "He has many things to do."

The Shaman was obviously offended. "And our chieftains sit on their hands? You cannot make decisions for your chief."

"But I assure you, I can. I have his full authority."

"You are shaman, not chief," persisted the Shaman. "Shaman guides chief, not takes the place of chief."

"Pardon my muddiness," crooned Zarber, "but I am not a shaman. I am a speaker for the chief."

"*Not* Shaman?" The horselike face displayed the "This is offensive/distressing/horrifying/unparalleled news" expression. She turned her dark violet-blue eyes to Rhys. "Are you not a shaman, too?"

Rhys glanced from the Shaman to Zarber. "I am a shaman," he said succinctly.

The Pa-Kai reacted by carefully opening her circle of stones and mincing across the tent to meet Rhys face to face. She jutted her chin at him and pointed at his chest. "You bring your chief and we talk. You," she added, with a clipped gesture at the Bristol-Benz group, "bring a shaman *and* a chief, then we talk."

That said, she flourished her bell-stick, whirled in a rainbow of fabric, and trotted from the tent. The Elders and other Shaman immediately dispersed.

"Whoof!" Rick Halifax shook his head. "That was a quark!"

"No, I should have anticipated it." Rhys picked up his brief-comp. "Let's go retrench."

"So, Llewellyn," said Zarber's bottomless voice from behind him, "what do you suppose you gained by pretending to be the Tanaka Shaman?"

"And what makes you think I'd tell you?"

The older man smiled, looking like a cross between a freshly fed Count Dracula and a cheerful mortician. "Just checking. Tell me, you aren't really going to ask Danetta Price to come out here and pow-wow with the natives, are you?"

"Do I have a choice?"

"You could use your imagination . . . that is, assuming you've got one."

"Use my imagination. You mean lie?"

Zarber shrugged. "You're already doing that, aren't you . . . *Shaman?*" He gathered his team and left.

"Are we going to ask Ms. Price to come to Pa-Loana?" asked Yoshi.

"If we want that foon, I think we have to."

"Are you sure this is necessary, Rhys?" Danetta Price looked a litte skeptical and a lot harried. "I'm in a middle of a buy-out of Goodyear and the B-B shooters are giving us a hell of a time."

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"Tell me about it," said Rhys. "I've got Vladimir Zarber at this end."

"Oh?" Danetta was suddenly very interested. "That explains why he's not here. It also means they think this foon thing is as important as we do. . . ." She chewed her lower lip, frowning. "By the way, you have my sympathy . . . about Zarber. But do you really—"

"Yes, I do think it's necessary. The tribal ettiquette demands that both chiefs and shaman be involved in any negotiations that affect the tribal clans. I've already established myself as the Tanaka Clan Shaman. Now, we just need a clan chieftain."

"Lord, this is right up your ethnic alley, isn't it? Do they wear plaid kilts?"

"No, more like paisleys and feathers. Can you come, or shall I pack up and hie home?"

Danetta Price heaved a gigantic sigh. "What's Bristol-Benz doing?"

"I think Vladimir is considering bringing in a ringer. He's got a backlog of assistants to draw from. The only problem is, they're all fairly young. He had his senior assistant and secretary with him today, and he's already established that neither of them is the chieftain."

"Do you think the Pa-Kai can tell a young human from a mature one?"

"I don't know, but I have a suspicion this Shaman of theirs could. They're humanoid themselves—or pretty much so. I can tell their young ones from the senior citizens. Although, I have to admit, that's partly a function of dress. . . ."

"Get that introspective look off your face and advise me, Rhys. What do you think?"

"I think if we don't want to have to purchase all our super-latex from Bristol-Benz, you'd better take the next TAS shuttle to Pa-Loana. I'm not going to snoot these people with a bogus chieftain."

Danetta sighed again. "Damn your ethical hide, Rhys. All right, you're the professor. Is it nice there? How's the weather?"

"It's beautiful. Lush, green, violet skies, mild temperatures."

She smiled. "Sounds like Newscot —except for the violet skies. You ought to be right at home."

He returned the smile. "Well, there aren't any stone circles, but I like it. When you get here, I'll show you the sights."

He broke the link and sat for a moment, staring at the blank screen of the com-unit. Then he went to find the shuttle's captain.

"I don't understand," said Yoshi, frowning at the colorful piles of cloth. "Why are you making a costume?"

Rhys selected a vibrantly green rain tarp and flung it over his shoulders. It clashed agreeably with the red of his tartan. "I'm a shaman, aren't I? I want to look like one."

"Count Vladimir is going to laugh his fangs out," warned Rick.

"Let him. If his fangs fall out, so much the better for us. Now, I want you to do a little reconnaissance work. Go hobnob with some apprentice shaman. Check out what they wear and how they act. Then, we'll design some costumes for you, too."

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"Are you serious, Professor?" asked Rick, squinching up his forehead.

"Look, Roddy, we've already made a not-so-wonderful first impression by appearing in 'young, dirty' clothes. We need to improve on that, don't you think?"

Yoshi frowned. "What does that mean—'young, dirty' clothes? Why did the Shaman say that?"

"Take a look around the villages. See if you can figure it out for yourselves. Now, get on it." Rhys adjusted the bright orange fingers he'd cut from a pair of Tanaka OmniClime all-weather gloves into a cockscomb atop his very red hair. He waggled his head to make sure they'd stay put, then left the shuttle.

He managed to locate the Eldest's Shaman without too much trouble and approached her, making the "Your humble equal approaches you" face and matching gestures. He sidestepped the last three steps to stand before her, underlining his appreciation of her station.

"You have put off your young, dirty clothes," observed the Shaman.

"That was my costume of travel," explained Rhys lightly. "We came to you straight from our ship and had no time to put on our proper clothing."

The Shaman nodded, looking Rhys over carefully. "You are much prettier," she said, then made the "Listen, I am saying something important" face. "A Shaman must never forget its dignity," she told him. "Better you should dress well and be late than appear in the Council Tent in a child's clothing."

Rhys nodded and looked woebegone, letting his shoulders droop. "This is so," he sighed.

The Shaman put her long narrow hand on his shoulder and canted her head to one side. "You are very young," she told him, "but I feel you have the colors of a good shaman. You can learn much by watching your elders."

"It will be a privilege to learn (most humbly) from you, O Colorful One."

The Shaman smiled toothily. "Your praise is singing. Now say why you have come."

"I wished you to know, O Bright and Shining One, that my chieftain will arrive in four of your days and will be honored to sit in the Council Tent of the Pa-Kai."

The Shaman made a "Have I heard you correctly?" face and said, "Why does it take so much longer for your chief to arrive? You and not-Shaman Rumble Mouth are from the same world, yet he sends an elder to tell me his chief will arrive tomorrow morning."

Rhys wished he could just bring himself to tell the Shaman that was because the Bristol-Benz "Chief" was a fake, but his personal code of ethics forbade that bit of backbiting. Besides, as far as he knew, the Pa-Kai didn't have a word for fake. He suspected they would after associating with humans for any length of time. He didn't have any way to explain time-altered space travel to the Pa-Kai either, so he settled for trying to bill Danetta Price as a conscientious sort of chief, in Pa-Kai terms.

"Your wise eyes will easily see why that is," he said. "My chieftain is a female and she feels she must see to the needs of her clan families before she can be free to do business."

The Shaman nodded approvingly. "An honorable chieftain. I will advise

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the Eldest that we should wait for her arrival before speaking again of foon. It would be only courteous to do so."

"Thank you, Most Splendid Shaman!" exclaimed Rhys, bowing deeply, then capering two steps to one side. "I am fulfilled."

"Welcomes, young Shaman. Now, it would please me if you would adore to see my laboratory/workshop/office/place of colorings."

Rhys boggled at the rich palette of nuances the last word provided. He understood clearly, however, that he was being singled out for the Shaman's special attention. He accepted her invitation eagerly.

"Your place of colorings will be my School Tent, my Great Tent, my paradise," he said and realized that a deep part of him meant it in more than the polite sense.

Vladimir Zarber was furious when he heard that negotiations would be held up until the arrival of the Tanaka CEO. He didn't *look* furious or *sound* furious—at least not in front of the Pa-Kai. In front of the Pa-Kai he nodded and cooed and said merely that the chief of Bristol-Benz would be disappointed. In front of Rhys and his team Zarber was considerably more disgruntled.

"What did you do?" he asked Rhys suspiciously. "How did you get them to postpone the talks? I had that Shaman convinced our chief was honoring them by showing up so fast. She was suitably impressed."

Rhys scratched his jaw and gazed cross-clearing at the Pa-Kai's collection of nineteen villages, glowing in the twilight. "I only told her our chief had some things to take care of on Jamal first."

Zarber's eyes narrowed. "*That* should have put her off. You didn't tell her . . ."

Rhys could tell he was searching for the appropriate euphemism. "What, that there was no way in God's great cosmos you could get your CEO here by tomorrow morning? No, Vlad. I didn't make a peep. Your . . . fairy tales are your concern. I'd only expose one of them if I thought it might endanger somebody."

"You make me sound like a crass materialist."

Rhys shook his head. "You're a businessman, Vladimir. Neither pure nor simple. But I do admire your style."

The older man raised silken brows in an arc of surprise. "Why, thank you, Llewellyn. Dare I hope that praise is sincere?"

"I'm always sincere."

"Yes, you are," agreed Zarber cheerfully. "And *that*, young man, is bound to be your undoing in this business. You have neither the ability nor the inclination to prevaricate."

Rhys shrugged. "I've always subscribed to the belief that, more often than not, honesty really is the best policy."

"That is a subscription best canceled," retorted Zarber, visibly pleased with the glib pun. "Most developed cultures expect cleverness in business dealings, whereas our primitive hosts here would be offended by what you call sincerity."

"I'm not sure I agree with your definition of cleverness, Vladimir. But I think our 'primitive hosts' may be quite offended to discover that your 'Chief'

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is one of your assistants, and that the real CEO of Bristol-Benz couldn't be bothered to attend the negotiations."

Zarber's expression darkened. "Is that a threat?"

"No. I've already told you I have no intention of pulling your covers off."

"Then the point is moot, isn't it? Since there's no one else around to pull my covers."

"I suppose so. . . . Look, it's getting dark and we've got a state dinner to attend." Rhys glanced toward the tent village again.

"Oh, yes, of course. And I suppose you're looking forward to it."

"Yes, I am. Now, if you'll excuse me. . . ?" Rhys gave his competitor a slight nod and headed back to the shuttle.

He really was looking forward to the banquet, he realized as he donned his flamboyant shaman's garb. His afternoon in the company of the Pa-Kai Eldest's Shaman, Pa-Lili, had been interesting and productive. Pa-Lili had given him a tour of her workshop, performed several characteristically Pa-Kai magics for his edification and taken him on her "rounds," explaining certain spells, tonics, and cures as she executed them. In turn, he had demonstrated the workings of both his communicator/ recorder and his brief-comp, and shown her what humans made with foon. He'd used his own purple dress unisuit by way of example, as well as the waterproof fabric of his "cape," and the flourescent splendor of his head ornaments. Pa-Lili had been very impressed, although a bit disappointed to hear that his dress kilt was fabricated from the wool of a creature that thrived only on Earth and one or two of its colonies.

She'd made such delightful noises over his entire outfit that he had promised to make a gift of some similar garments. His preparation for the evening's festivities had included the careful folding and wrapping of those gifts, which now reposed on his bunk-side unit next to the little pile of shamanistic fetishes and charms Pa-Lili had insisted he have to fill his sporran (which she had taken to be an empty medicine pouch). He smiled at them, feeling a genuine fondness for the Pa-Kai Shaman, and put on the lulac stone necklace with its small pendant spirit bag. It clashed wonderfully with the rest of his outfit and he knew Pa-Lili would approve. And so, he thought, might his ancient Celtic ancestors.

His assistants, on the other hand, did not approve.

"Do we really have to wear these crazy get-ups?" whined Rick. "I look like a neo-deco Franciscan monk."

"No, you look like a Pa-Kai apprentice shaman," said Rhys. "Franiscan monks didn't wear that particular shade of chartreuse."

"Aren't we taking this 'when in Rome' stuff a little too far?"

"Not if it makes the Pa-Kai more comfortable with us."

"But why are we pretending to be shaman?" asked Yoshi, peering at him from beneath the nest of colorful cloth strips that festooned her hair. "I thought you said we should always be honest in our dealings with indigenous cultures."

"Who said anything about pretending? All three of us are the product of cultures in which shaman played an im-

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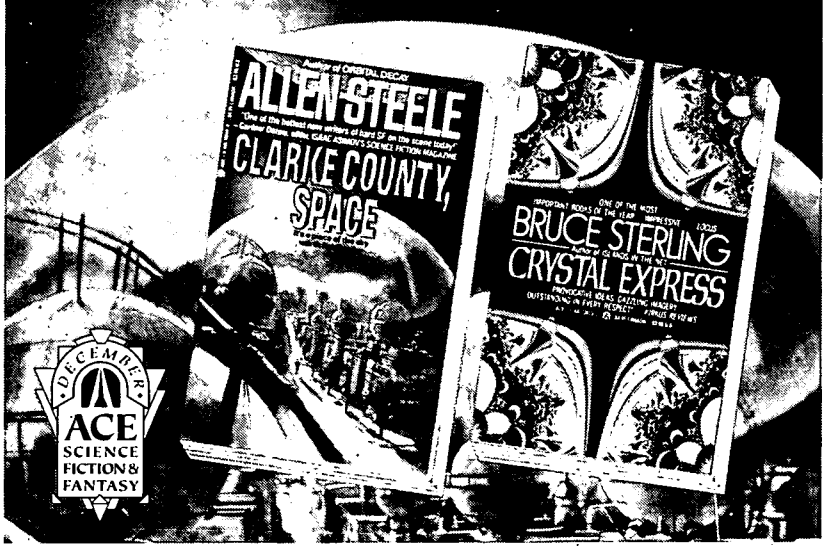

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portant early role. We're just reaching back to our own roots." Rhys studied the two dubious faces for a moment, then sighed. "Look, I realize this is a bit different from our usual negotiating style. Normally, we'd just throw on the dress clothing, behave in what is generally accepted to be a civilized manner, and offer the sought-after goods and technologies. And I realize you two are out of your element here. But consider this: We know that as far as the Pa-Kai are concerned, there are two parties necessary for official, binding negotiations—the chieftain of the clan or tribe and the ranking shaman. If our CEO is the equivalent of their eldest—"

Yoshi nodded. "Then you're the logical equivalent of their shaman and the shaman must have apprentices and we have to look and act the part."

"Exactly. And when it comes to looking and acting the part, there is a . . . slightly different measure of decorum among the Pa-Kai than we're used to. The clothing we consider businesslike, they consider . . . unworthy."

Yoshi continued to nod, her dark eyes lighting. "Yes. Our clothes seemed dirty to them—drab like the clothing worn by their children—little color."

Rick blinked at her. "Is that what that was all about?"

"Didn't you notice? The young Pa-Kai wear drabber colors than their elders. I would say you *earn* your colors on this part of Pa-Loana. It's a sign of status."

Rhys was pleased. The girl had the makings of a good cultural anthropologist. He wondered what either of them was doing in a negotiating team for a major corporation.

Rick nodded. "All right. So we look young and dirty. And since we want to impress them as mature and capable—" He shook his colorful habit.

"You've got it. But don't forget the behavior part of the equation. A shaman is obviously expected to use full range of body language to communicate. Our mannerisms probably seem . . . weak or even secretive to them."

Rick's eyes glinted with a sudden spark of realization. "Then, Count Vladimir, with his dress blues and dignity fetish—"

"May find that what were once assets are now liabilities," finished Rhys. "At least, that's what I'm hoping." He crooked his finger at them. "Let's go."

"But," said Yoshi, falling into step beside him, "what if Zarber catches on?"

"I'm hoping he won't. After all, he accused me of the same thing you did —pretence."

Yoshi blushed. "Sorry, sir."

"No apologies necessary. Now, think shamanistic thoughts and smile."

The Tanaka contingent arrived at the collective village circle to find that the Bristol-Benz party had preceded them. Dressed in a midnight blue full-dress unisuit, Vladimir Zarber's expression went from arch to stunned to incredulous to amused and back to arch again, in remarkably swift succession. He strolled over to Rhys with all the swagger of a nineteenth-century buccaneer and looked him over from head to toe with a scathing, chuckling glance.

"What in the name of creation are you made up for, Llewellyn? Have you gone completely mad?"

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Rhys smiled. "Not that I know of. I'm just trying to fit in with the other shaman."

"Really? You could have just explained that where we come from, shaman don't dress like that. That's what I intend to do if the subject of my 'youthful' garb comes up again. After all, Llewellyn, in our common culture, it's the immature who costume themselves in garish abandon."

"That's true. But this isn't our culture, common or otherwise."

Zarber shook his head. "Honestly, I can't imagine what Danetta Price was thinking of to hire a professor of anthropology over someone with Ph.D.s in business psychology and diplomacy. You are completely unqualified for this line of work, you know. You belong in a dusty little museum somewhere, pottering about with bones and poring over hieroglyphics. It astounds me that you've enjoyed as much success as you have. I can only credit it to your beleaguered support staff." He flicked his gaze to Umeki and Halfax, who met his eyes with cool insolence. "You're an archetypal nerd, Llewellyn," he said flatly. "And you're turning your assistants to nerds, too."

"So there!" muttered Rick when Zarber had stalked off again. "I guess that puts us in our place. What was that about Price picking an anthropologist over a doctor of biz-psych?"

"I don't know," said Rhys thoughtfully. "Curious comment, wasn't it?"

A gong sounded just then, announcing the arrival of the Eldest and his Shaman. There was a general clearing away of Pa-Kai along his preferred route as he was carried to his place in the banquet circle by four hefty specimens, each bearing a corner of his carved and ornamented pallet. He was preceded by Pa-Lili and followed by a standard bearer whose pole-top pennant blazed with the Eldest's Clan emblem.

Rhys and his assistants bowed and bobbed along with the Pa-Kai, then went to greet their seated host. The Shaman showed them to their seats. She put Rhys to her right and Zarber to her left. Each set of apprentices sat flanking their Shaman. Rhys felt intuitively that the arrangement augured well, if for no other reason than that by placing him so, Pa-Lili seemed to be expressing a preference for his company.

She heightened his suspicion of favoritism by addressing him with great familiarity during the ensuing meal. At one point, at having told what passed among the Pa-Kai as a joke, she even slapped him sonorously on the back.

Zarber, on the other hand (quite literally) she treated with pronounced decorum. She referred to him always as "Shaman Tsar-Bar," and never once slipped from the Pa-Kai formal equivalent of the Old Earth "you" into the more familiar address she used with Rhys. Rhys was pleased with that, but he was the slightest bit uneasy about the fact that Zarber seemed as pleased with her formality as he was with her familiarity.

Just as bemusing was the title "Shaman" being accorded to a man who, earlier that day, Pa-Lili had referred to as "not-Shaman Rumble Mouth." Taking advantage of Zarber's distraction by the food and entertainment, Rhys turned to Pa-Lili wearing the "Question?" expression.

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"Pardon my nose, O Radiant Pa-Lili, but may I ask why you refer to Zarber as a shaman? I thought I heard him say he was not a shaman of the Bristol-Benz Clan."

"Ah." Pa-Lili nodded. "Yes, that one was a little confused. He said he did not understand what was being asked of him. The word 'Shaman' was not familiar to him. He said among the members of his clan he is called 'Doctor.' " Her violet eyes gazed at him very directly. "*You* had no trouble with the word."

"We are from different tribes," explained Rhys. "Our training was very different."

"He has more age than you, Reeslooelen." The name rolled off Pa-Lili's long slender tongue with a fluidity Rhys had thought possessed only by native speakers of Gaelic.

He smiled and nodded. "Yes, he's quite a bit older than I am."

Pa-Lili displayed a most human frown of bemusement and commented, "He dresses very young. Perhaps he is not comfortable enough with age to admit to it."

Rhys swallowed a chuckle. "May I also ask why you are so formal with Shaman Zarber?"

"I do this because he likes to be addressed from a distance," said Pa-Lili. "It strokes him. You would be put off with such formality."

Rhys bit the inside of his lip. He'd been wrong. Pa-Lili was obviously very sensitive to the personality quirks of other beings. As she was "stroking" Zarber with formality, she was "stroking" him with intimacy.

"And besides," Pa-Lili said, after a moment of thought. "I like you."

Rhys quite nearly blushed. He felt a rush of pleased surprise. "I like you, too," he told her.

She blinked and made the "This pleases" face, her crest hair rippling visibly. She patted his hand. "You wear my gift spirit bag," she noted.

"Oh, yes. Thank you, Many Hued Pa-Lili. Your gifts were most generous. My medicine pouch is full."

"What spell do you weave—or is it a secret one?"

Rhys mind went blank except for the entirely irrelevant thought that no one had ever asked him that before and was this what it was like to attend a Sorcerer's Convention.

"I would like to weave a spell of good will and complete honesty," he said. That sounded innocuous enough and seemed to please Pa-Lili.

"And what, then, are the contents of your bag?"

"I, uh . . . it's empty." He knew that was wrong and gritted his teeth, waiting for Pa-Lili to register her offense at his ineptitude.

She merely shook her head and clucked at him from somewhere deep in her throat, her long face saying, "Poor baby." "No spell may be drawn from an empty bag," she told him with the air of one repeating ageless advice. "You must place the spell weaver within."

Rhys blinked, sensing his apprentice's eyes hot on the sides of his perspiring face.

"A spell-weaver?" he asked limply.

Pa-Lili chuckled again. "What do they teach you on your world, Rees-

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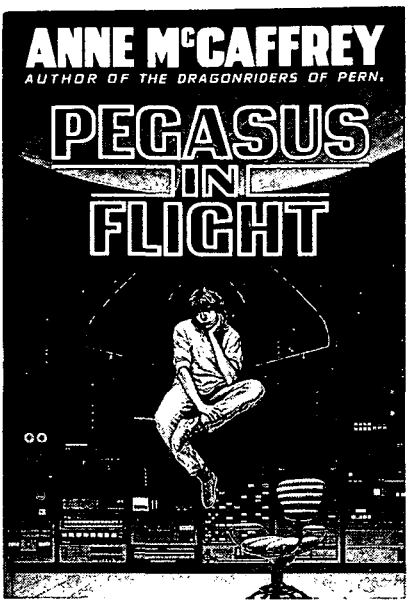

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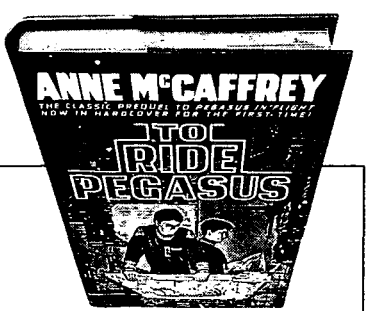

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looelen?'' She began a rhythmic recitation: ''Within the bag must live/the fetish that will power give. Within the bag must dwell/the talisman that weaves the spell.'' She raised a long finger. ''If a thing is to be tagged a piece of it goes in the bag. If a person is to be touched a bit of their life will serve as such.''

She finished the musical little chant and nodded once, then she turned her eyes to Rhys. ''They do not teach you this?''

''Not exactly, but I think I understand.''

''I don't,'' said Yoshi unexpectedly. She colored as both Rhys and Pa-Lili turned to look at her. She pressed her hands togther before her chest and bowed her head deferentially. ''Pardon me, Most Wise Ones, but what does it mean—'a bit of their life?' How can you put a bit of someone's life in a bag?''

Pa-Lili deferred to Rhys. ''Will you explain to your apprentice, Reeslooelen?''

Rhys nodded. ''Certainly.'' He turned to Yoshi and crossed his fingers under the billow of his cape, hoping that Pa-Kai Shamanism followed the same rules as the ancient Earth cultures he'd studied—his own included. ''What the Sagacious Pa-Lili means is that something pertaining to the person for whom the spell is intended must be placed in the bag to—ah—to bind the spell and to . . . point it the right direction.''

Out of the corner of his eye, Rhys could see Pa-Lili twitching the end of her camellike nose in agreement. He heaved a mental sigh of relief.

''Well spoken,'' said the Pa-Kai Shaman. ''The bag contains the pointer to the spell, for the spirits/angels must know where the spell is to go—to what or whom it must be bound. So, you give them a twist of hair, a drop of blood, a slice of skin. If many people are involved—many bits of life go into the bag.''

Yoshi looked queasy. ''Blood and skin?''

Pa-Lili gave an artless Pa-Kai shrug. ''Eh, those things are needed only for the most potent of healing or educational spells.''

''Educational spells?'' Rick echoed.

Pa-Lili looked at him sternly down the length of her nose. ''You don't know about educational spells?''

''They are very young apprentices,'' Rhys defended them. ''Also on our world shamanistic apprentices tend to—um—specialize.''

''A serious mistake, Reeslooelen,'' remonstrated Pa-Lili. ''If everyone specializes, there will soon be no masters of the total discipline. A shaman is by nature a general practitioner—a Knower of All Knowledge. How else are we to intelligently advise our chieftains?''

''So true,'' said Rhys, his ''Sigh'' face barely hiding a smile. ''I have often felt that on our worlds the knowledge of each successive generation of shaman is narrower than the one before. These children would benefit much by your knowledge, O Flamboyant Pa-Lili.''

Pa-Lili's crest danced. She raised her elongated head and gazed fondly at the ''children'' through her sweet eyes. ''An educational spell is used when the student is too dense to learn the normal way. It is a great restorer of law and order for those who cannot control their behavior.''

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"You mean, um . . . " Yoshi began, then stopped in bemusement. She turned to Rhys. "How do they say 'criminals?' " she asked in Standard.

"Actually, they don't seem to have a word for them." Rhys made the "How surprising!" face at Pa-Lili. "Do you mean that when people, er, misbehave or do wrong things you put a spell on them to . . . instruct them?"

"To instruct and enlighten, yes. These are our educational spells."

"Do they work?" asked Rick incredulously—for which Rhys would have cheerfully kicked him, if he could have reached that far.

"Of course, they work!" hooted Pa-Lili. "What good is a spell that doesn't work?" She turned to Rhys and murmured, "This apprentice needs much remedial work. You might consider using a bit of an educational spell on *him*."

Rhys chuckled. "You may be right, O Wise Pa-Lili."

"I would wager the Wise Pa-Lili is seldom, if ever, wrong," said Vladimir Zarber's voice.

Rhys was pleased to note the fleeting expression that crossed Pa-Lili's face before she turned to include the Bristol-Benz negotiator in the conversation. The Advanced Lingual Base had translated it as, "An insect has just landed on an unreachable part of my anatomy."

In the next three days, Rhys and his two "apprentices" spent much time in the company of the Pa-Kai, taking tours of the nineteen clan villages and "talking shop" with every shaman they could collar. Pa-Lili's personal apprentices were eager to display their knowledge to their human counterparts and gave a good deal of their time to do so.

"Today," said Rick at the end of day three, "we learned three different ways to cure crest-hair loss and a couple of incantations for Pa-Lili's so-called educational spells." He set his recorder down on the table in the shuttle's small passenger lounges and peeled off his crest cap.

Rhys nodded at the recorder. "You put them on disc?"

"Sure, why not? I figured you'd be interested in their anthropological value . . . Prof," he added, grinning. "And besides, I think they're pretty hooky tunes. Put a band behind 'em and you've got some real hits. Here, give a listen." He turned the recorder on.

A melody of fluid grace cascaded out of the tiny machine accompanied by the rhythmic beat of a tuned drum and the crystalline *ching!* of some native chimes. Rhys was charmed. Yoshi smiled with delight, humming along.

"That's wonderful!" said Rhys when the chants were finished. "You were right—I think it's absolutely fascinating. What instrument was Hi-Pok playing?"

"A padachi," said Yoshi. She searched the medicine pouch Thuili, Pa-Lili's female apprentice, had given her and came up with what appeared to be a tiny kettle drum with a handle. At the end of the colorfully wrapped handle was what looked like a green glass ball with a grinning mouth. Within the ball was a smaller ball made of some bright, golden metal. "She even showed me how to play it." Yoshi rolled into a sweet rendition of a soft, dreamy chant.

Rhys smiled, settling comfortably

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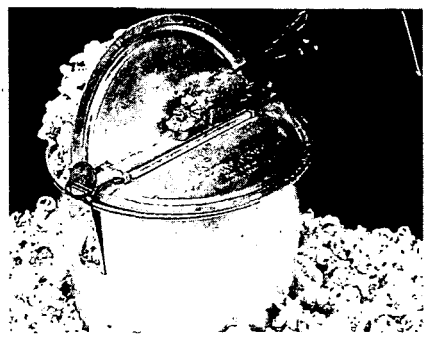

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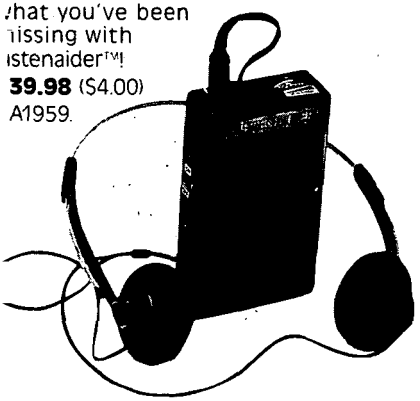

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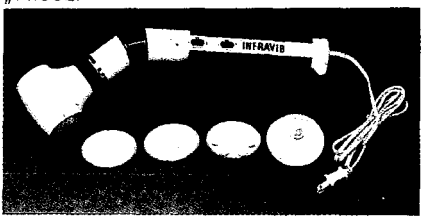

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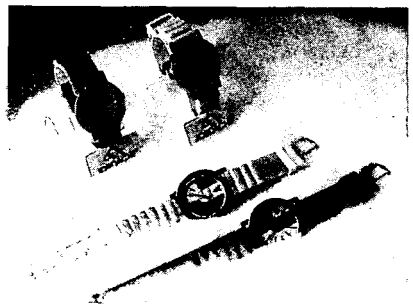

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into a lounger to listen. The little piece made him think of hot cider and glowing fireplaces and vivid, soft plaid blankets.

He pulled himself from the drowsy reverie when he realized Yoshi had stopped singing. "That was—that was exquisite. What was it?"

"Thuili called it a rulurulu—a cradle charm. They use it to put sick or restless children to sleep."

The warm wash of his own amazement brought Rhys fully awake. He glanced at Rick, ready to admit laughingly that the charm had certainly worked its magic on him. But his apprentice was fast asleep, curled cozily among the voluminous folds of his chartreuse robes.

Yoshi giggled. "It had the same effect on him when Hi-Pok chanted it today."

"It did?"

"Well, he didn't fall asleep, but he got pretty dozey." She handed Rhys the padachi. "I guess it's all that late night feasting and dancing we've been doing, huh?" Her face said she wasn't sure she believed that.

"Yeah, I guess that must be it," agreed Rhys, turning the little drum over in his hands. The little ball-chime sounded musically and Rick stirred, smiled, and cuddled further into his habit.

"Makes me sleepy just looking at him," yawned Yoshi. "I think I'll turn in. What time is Ms. Price due in from Corporate tomorrow?"

"Uh, sometime in the late afternoon, if she's on schedule."

"Oh, good. Well, goodnight, sir."

"Goodnight, Yoshi." Rhys got up, wondering if he should wake Rick or let him sleep. In the end, curiosity got

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the better of him. He crossed the cabin and shook the other man's shoulder.

"Huh?" Rick blinked, brought his eyes into focus on Rhys's face, then struggled to sit up. "What—?"

"You fell asleep."

Rick made a disgusted face. "That damn cradle tune again."

"You think it works?"

Rick shrugged, coloring. "It's certainly a relaxing little ditty."

"Just out of curiosity, what were you thinking about just before you . . . succumbed?"

The color in Rick's face heightened. "You'll laugh."

"Only if I was thinking similar thoughts."

"Well . . . when I was a kid, my mom would read me books in one of those old flotation chairs. She'd turn the heating unit up just a bit and I'd sit there bobbing up and down in her lap drinking hot chocolate, and about the middle of the second story . . ." He shrugged. "She never once let me spill the chocolate."

Rhys chuckled. "I was having hot cider before a roaring fire wrapped in my favorite blanket." He looked at the padachi again, shaking his head. "Old wives' tales and folk magic—they've done well by humanity for millenia."

"This isn't the beginning of a lecture on folklore, is it, Prof?"

Rhys caught the look on Rick's face and laughed. "No, Roddy, I'll spare you that. Go ahead and get some sleep. We have a big day tomorrow."

He picked up Rick's recorder, popped the tiny disk out and slipped it into his sporran, tossing the recorder back to its

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owner. "See you bright and early, Apprentice Roddihalfs."

They breakfasted at 0700 hours planetary time in a pleasant glen hard by the shuttle, still dressed in their shipboard "drabs." Rhys Llewellyn drank five cups of coffee and jotted notes on his pocket recorder.

"You look tired, sir," observed Yoshi, then smiled shyly. "Did the lullabye wear off?"

Rhys shook his head. "I had some preparations to make for the negotiations tomorrow morning."

"But you have all day to do that, don't you, sir?"

"Today we'll need to make strategic and physical preparations. I figured I'd get the computer work out of the way last night."

"What physical preparations?" asked Rick, munching a piece of native fruit.

"We'll need a banner, for one thing."

"Pardon?"

"Haven't you noticed that whenever a group of chieftains gather they each have a clan banner behind them?"

"I noticed. But we don't have a clan banner."

"No. We have a corporate logo. And your job for the day is to see that that logo is put onto a banner. A very colorful banner. There's still a good supply of those OnmiClime tarps, which fortunately come in a myriad of designer colors. By the by, there's also the matter of Ms. Price's pallet. The Pa-Kai will supply the wooden frame and set it up in the banquet circle, but it's up to our clan to provide proper ornamentation. Yoshi, you're the ornamentation committee. See if you can determine what the well-turned-out chieftain is supposed to deck his or her deck in."

Yoshi nodded eagerly, her eyes kindling. "I've already got a pretty good idea. It seems to be related to the goods a particular clan produces. . . . This is fun, sir."

Rick snorted, whether at Yoshi's comment or the approaching visitor, Rhys wasn't sure.

"Don't look now, but here comes the Count and he doesn't look happy."

That was an understatement; Rhys decided. Zarber looked incensed. In fact, if smoke had been curling out of his ears, it would have seemed completely natural.

"To what do we owe this pleasant—"

"I have no intention of making this pleasant, Llewellyn," he said in his most profundo basso. "You are a scoundrel; an underhanded, sneaky, spineless individual—"

"Yes, I know what a scoundrel is, thank you," said Rhys mildly. "How does it apply to me? I thought I was an archetypal nerd."

"You," returned Zarber, "have been fraternizing with the natives. Sucking up to that Pa-Kai medicine man all week, putting on your silly costumes, clutching your pouches, dangling your spirit bags. You've been working on a deal behind my back!"

Rhys sat up, his own temper on a sudden rise. "What kind of a half-assed accusation is that?"

"Rather more than half an ass, I think. Neither my assistants nor I have been blind to your dark plottings. You've monopolized not only the Shaman's time, but its apprentices, as well. We

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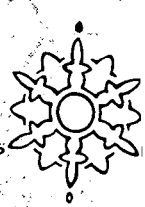

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haven't been able to get so much as a ten-second audience."

" 'Dark plottings?' Don't be so melodramatic. We're just being friendly and trying to win their respect. There's nothing sneaky about that."

"You're doing more than being friendly, you're currying favor. You're—"

"And what are you doing with the Eldest in the meantime?" asked Yoshi unexpectedly. "You and your so-called chieftain have been having teapots with him every morning and bringing him little imported goodies every afternoon."

"We were invited."

"So were we. Pa-Lili invited us to fraternize. It's only courteous to accept the invitation."

"Is that what you call this silly masquerade—this shamanizing nonsense? Courtesy? You're making fools of yourselves."

Rhys's mouth puckered thoughtfully. "Maybe you're right . . . but would you like to bet on it?"

Zarber's eyes narrowed, making him look as if he'd just bitten into a lemon (or into someone who'd just eaten one). "What do you know, Llewellyn, hmm? What privileged information have you weaseled out of that Pa-Kai windbag?"

Yoshi gasped. "You're a very rude man," she told Zarber indignantly. "That's a terrible thing to say about Pa-Lili. She's nice!"

Rhys smothered a laugh. Yoshi reminded him strongly of a certain little girl from Kansas facing down a certain cowardly lion. All she needed was to be clutching a little black mongrel. The impression was obviously shared by Zarber.

"Are all of your associates as gullible as Dorothy, here, or is that just an act?" he asked.

"I think Yoshi is right," said Rhys. "The only windbag around here is you. Now, if you'll excuse us, we have a lot to do before the negotiations begin tomorrow morning."

Zarber glared at Rhys, iron-faced. "I'll just bet you do. Well, I can play charades, too, Llewellyn. Probably better than you can."

"Ooh," said Rhys, clutching at his collar. "I'm scared."

Zarber flushed a deep scarlet and left with long, dignified strides.

"If he could arrange to turn that color in front of the Pa-Kai, he might score some points," observed Rick. "Geez, he's slick. Slick as a wet rock." He turned an admiring eye on Rhys. "You handled that beautifully, by the way. . . . *Are* you scared? Of losing this one to the Count, I mean."

Rhys nodded. "Terrified."

"I'm not," said the stalwart Dorothy. "I know you can outmaneuver him, sir."

Rick snorted. "I just hope he's not better at playing charades than we are."

"Who's playing charades?" asked Rhys. "I'm not. I hope you're not. And if Zarber is, then he might just sabotage his own position."

"We could help," suggested Yoshi. "Just let me get a lock of his hair."

"Good God, what for?" asked Rick, staring at her.

"Don't you pay any attention to Hi-Pok and Thuili? You put the hair in the spirit bowl, immerse it in pure water,

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and lay the curse. Then you put it in the spirit bag so the spirits will know what to do and you wear the spirit bag over your heart so you can help direct their efforts. Very simple."

Rick ogled. "You don't really believe that stuff."

"Why not? The rulurulu worked on you—twice."

"I was exhausted and the melody was soothing. Big deal."

Yoshi shrugged. "So, don't believe. Laugh at your ancestors. I'm sure they don't care."

Rhys watched the exchange with quiet amusement. For all his study of the cultural lore of a thousand civilizations, both major and minor, he'd never come to a definite belief about magic. His own ethnic history was saturated with it—tales of the Druids, the Ancient Ones, the Elements; legends of Merlin (Myrddin to his Gaelic and Welsh-speaking forebears); tales of stone circles and moonlit rites of power-dark sorcery. Yet his beliefs were nebulous—much less studied than the dry-paper facts and academic theories that were the meat of the twin fields of anthropology and archaeology.

Belief. He believed in a Deity, he knew that. And he'd always supposed that Deity communicated with Its myriad creatures in whatever way was comprehensible to each kind. Magic, spells, prayers (curses, even) could certainly qualify as the creatures' response to that communication. He tried to keep an open mind into which evidence the effects of the rulurulu could freely fall. And, when the evidence hit bottom—

"Come on, Professor. Tell her she's being brainwashed." Rick was insisting. "She thinks you're going to put a curse on this guy."

Rhys shook his head. "No. I'm surely not going to do that. That would be . . . unethical, un-shamanly . . . downright scoundrelly. I don't believe in putting curses on people, Yoshi. But I do appreciate the thought." He stood and stretched. "OK. Everybody up. We've got work to do."

Danetta Price's shuttle arrived about two hours before sunset, setting down gracefully next to the other Tanaka vessel. The first thing she noticed about the small camp set up by the negotiating team was the colorful banner that flapped in the breeze, suspended on the crosspiece of a tall metal pole. It was emblazoned with the same stylized rendering of the Tanaka logo that adorned the two TAS shuttle craft. She admired it briefly, then went to the neighboring shuttle to find Rhys. She didn't find him, but did find Yoshi Umeki and Rick Halfax going over the environmental impact reports in the passenger lounge.

"Ms. Price!" Rick saw her first and rose quickly to greet her. Yoshi followed suit shyly.

"Hello, Roderick, Yoshi." Danetta shook their hands firmly. "Where's the professor?"

Rick nodded toward the airlock. "He went over to the village to visit with his buddy, Pa-Lili, and make some last minute arrangements for the feast tonight."

"His buddy, Pa-Lili?" echoed Danetta.

"The Pa-Kai tribal Shaman and head negotiator," explained Yoshi.

"Ah, yes. Of course." Danetta nod-

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ded, her eyes falling on a bright pile of fabric draped over one of the loungers. "What are those?"

"Ah, well . . ." Rick eyed the robes dubiously. "I think we'd better let Dr. Llewellyn explain—"

"Well, speak of the devil—" said Danetta, staring over Rick's shoulder. Then she broke into peals of laughter.

Rhys watched her paroxysms silently from under his crown of orange fingers, his splendid green cape clashing eloquently with purple unitard and multihued tartan plaid. "Hello to you, too," he said cheerfully. "You're just in time for a briefing before the cielidh."

"The what?"

"The party tonight. Ah, well, banquet, I suppose you'd call it, except it's a good deal more than that. There'll be food and song and storytelling—the Pa-Kai are quite good at all that. As good as the old Celts, come to it. But, excuse me for a minute, I have to go clean up. I got a little something on my cape."

"That looks like blood," said Yoshi. "You didn't hurt yourself, did you, sir? I have some quapai ointment." She pointed at her medicine pouch, slung over the arm of a side chair.

"Oh, it's not mine. It's poor old Vladimir's."

Three pairs of eyes assumed saucer-like proportions.

"Oh, sir, you didn't!" breathed Yoshi awfully.

"Good Lord, Rhys," said Danetta. "I know the man is your arch rival, but—"

"I didn't lay a hand on him, I promise. There was some hullabaloo going on in the village commons—a lot of party preparations and what not. Vlad just happened to be in the wrong place at the wrong time and got rapped by a piece of flying timber. They were trying to hoist this little tower affair for the fireworks tonight and he just got in the way." He grimaced and flapped the bloodied bit of cape. "I guess I was sort of in the wrong place at the wrong time, too."

"Was he badly hurt?" asked Danetta.

"Well, it got him in the mouth. May have chipped a tooth. Pa-Lili insisted on taking care of it, so he's in good hands . . . whether he knows it or not." He studied the stain for a moment, then grinned. "And there he stood, thirsting for *my* blood. Van Helsing lives." He disappeared in the direction of the cabins, humming a tune.

Danetta Price stared after him, a bemused expression on her face. "Is it my imagination, or has his brogue gotten thicker since you left?"

"It sort of thins and thickens," said Yoshi. "The better he feels, the thicker it gets."

"You can say that again," muttered Rick.

"So, it seemed to me that the best way of besting Zarber was to negotiate with the Pa-Kai on their own terms. If they believe a chieftain and a shaman must both be present to negotiate a deal, then we provide a shaman and a chieftain *as they know them*. And we bring them a *real* chieftain, not a mock-up."

Danetta nodded. "Which is what Zarber is giving them, I take it. I happen to know that William Benz is on his way to Earth even as we speak. He's going to be taking a nice little transit nap for the next couple of weeks."

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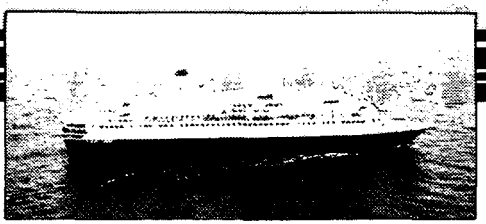

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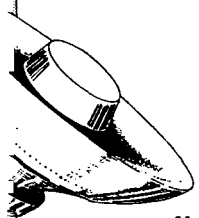

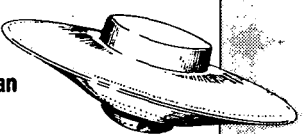

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"He's handpicked one of his tall, dignified, male acolytes to play the part," said Rhys. "The young gentleman has been spreading his dignified presence around the Pa-Kai villages for the past three days, shmoozing with the other chieftains. Meanwhile, in the absence of our own chieftain, we have been keeping company with the Shaman and her associates."

"Who dress like this?" Danetta lifted the freshly laundered hem of Rhys's cape.

"Exactly."

"Dare I hope that chieftains do not also dress like this?" Her hazel eyes were imploring.

"Oh, the chieftains are a much drabber lot," Rhys assured her. "They seldom wear more than two shades from opposite color groups at the same time and their crest adornments are much more—ah . . . "

"Understated?" suggested Rick.

"Well, they're not flourescent and they generally hang down the back as opposed to sticking out in all directions."

Danetta raised her eyes to Rhys's head. "I'm delighted to hear that."

They arrived at the evening's banquet just at sunset, when the torches and fires in the tribal commons were beginning to compete with the Pa-Loana sun for brilliance. Except for her very un-Pa-Kai features, Danetta Price looked the epitome of Pa-Kai chieftainhood. The robes she wore over a bright burgundy unisuit were Pa-Kai originals, procured from a village merchant who catered to the fashion whims of chief and shaman alike. It was, he assured them, the latest in royal garb and drew their attention to the way the headgear draped a vivid azure tail over the shoulder of the deep amber robe.

"I'm a regular work of art," murmured Danetta as she and Rhys marched side by side into the Pa-Kai village. Behind them, arrayed in shamanistic splendor, walked Rick and Yoshi, while bringing up the rear was a borrowed steward from one of the shuttles carrying the Tanaka banner on its tall pole.

"Wait till you see the other chieftains," said Rhys. "Believe me, you'll fit right in."

She did that, creating quite a stir among the Pa-Kai as they gathered to greet her and admire her finery. Rhys, meanwhile, kept his eyes open for the Bristol-Benz party. He couldn't have missed them if he'd kept them closed. As the horns blew announcing the arrival of the Pa-Kai Eldest, the Bristol-Benz "Chieftain" arrived at the entrance to the tribal commons carried on a pallet by four crewmen, each hefting a lit torch. The Eldest's pallet reached the same spot at the same moment. For a second the two passengers stared at each other, then Zarber's ringer made a cool, sweeping gesture for the Eldest to precede him.

Rhys watched Pa-Lili closely, catching the telltale shake of her head and the sour face she made. He smiled and relaxed. Trust Zarber to overplay a scene.

When Danetta had mounted her own tastefully-decorated pallet and everyone was seated about the huge central bonfire, two things stood out in plain relief—one was the elevated pallet of the Pa-Kai Eldest and the other was the

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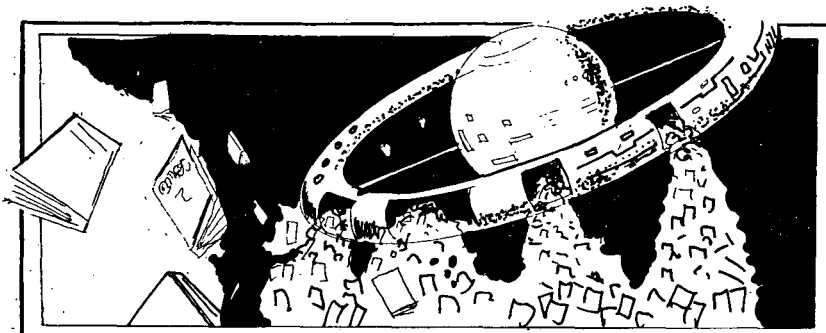

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equally elevated pallet of the Bristol-Benz impostor. For a second time the two chieftains looked at each other—one cool, the other at least seeming to be.

Rhys glanced over at Zarber, who, in an obvious effort to play Rhys at what he believed was his own game, had affected a bright red sash and matching beret for the occasion. Zarber gazed back, an impossibly smug, albeit dignified, expression on his bruised and lacerated face. He smiled, displaying a black hole where once an incisor had been.

The Pa-Kai Eldest spoke. "Tell me, O Chieftain Benz," he said, "When did you develop this infirmity?"

The other "Chief" blinked and glanced down at his "Shaman." Zarber shook his head, still watching the Pa-Kai for some clue.

"Pardon, O Eldest One," said the impostor coolly. "Your meaning flies by me."

"You are carried here on a tray. I ask what infirmity you have sustained since earlier today which causes this?"

Rhys had to admire the way Zarber slipped smoothly into the awkward silence. "My chieftain was so distressed upon hearing of my own accident earlier that he attempted to hurry to my aid. He slipped on the entry ramp of our ship and fell, spraining his foot." He finished the narration with a face that said, "How noble is my chieftain. How humble am I."

Rhys wanted to guffaw. The only thing that kept him from doing so was his native sense of courtesy . . . and the fact that Zarber's quick thinking had retrieved Bristol-Benz from what should have been an embarrassing situation. Hell, he'd done better than retrieve it. "Chieftain Benz" now looked like a sensitive, noble being and one hell of a nice guy—in Pa-Kai terms, a hero. Zarber's dignified bearing had finally made a favorable impression—it made him seem humble in a twisted sort of way.

Rhys glanced around at the solicitous expressions on the mobile Pa-Kai faces. Their sympathy was neither disguised nor feigned. The Eldest leaned toward the injured stalwart and engaged him in private conversation, the gist of which was lost on Rhys, who could only hear the fluting trills at the ends of certain phrases. Zarber was nearly grinning.

Rhys gritted his teeth. Maybe that old adage was true; maybe nice guys really did finish last. Maybe he should learn to play Zarber by his own rules.

He barely noticed the food being served, but sat pondering his next move until he felt someone nudge his ribs. It was Danetta Price.

"Hello there," she said, peering at him inquiringly. "Where have you been?"

He smiled ruefully. "Just wool-gathering."

"Wool . . . what?"

"An old rural expression. Star-gazing."

"Ah. So, Prof, tell me what's my next move? How do I pry the Eldest away from 'Chief Benz?' "

"I'm not sure. I . . . Danetta, will you tell me something?"

"If I can. What?"

"Zarber made a comment the other day about you preferring a professor of anthropology over a doctor of biz-psych. Any idea what he meant?"

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She nodded. "Sure. It's no particular secret. Zarber was one of the applicants for your job. We hired you—he went on to B-B."

Rhys was stunned. "You hired *me*?"

Danetta eyed him humorously. "I do imprint your pay account, don't I?"

"But, why me instead of Zarber? He already had a reputation as a crack negotiator."

"Yes, he did. On Earth and in the colonies and among the few cultures we've connected with that were, shall we say, of the same mind about business. But he had no experience with non-urban cultures. Not even the ones on Earth. This man thinks a peace pipe is an odd bit of scrap metal. If someone handed him one, he'd probably put the wrong end in his mouth. He knows the psychology of *human* business, *human* psychology and only a narrow bandwidth of that. And in my experience, it's not the urban society that has the most valuable resources to offer. I can handle the deals with urban humans myself—in fact, I like doing it. What I needed was someone who could deal with divergent cultures in their own language and in their own element. You can do that. It seems to come naturally to you." She waved the blue tail that hung over her left shoulder. "Do you think Zarber would have thought of adapting to Pa-Kai culture like this without your lead?"

Rhys shook his head.

Danetta smiled. "I know you have trouble understanding twenty-third century Urban Man, but you're damn good divining what makes someone like your friend Pa-Lili tick. Am I right?"

"I hope so," said Rhys. He sounded dubious, but realized he felt much better about the whole situation. "Then you don't mind this rigamarole?" He gestured at their combined adornment.

"Mind? This is a vacation, Rhys. Besides, how often does a woman in my position get to dress up like this . . . ? Now, how do I get the Eldest's attention?"

Rhys eyed the Pa-Kai leader. "Wait for a break in the conversation, then compliment him on the feast and the colors of his dress. End your leading sentence with praises like: Most Elegant One, Most Vibrant One. Refer to the color of his dress a lot. How varied the hues, how vivid. Then, apologize for being here four days late and explain that you had clan business that had to be taken care of. They set great store by conscientious leadership. You have an advantage in that you're female. The Pa-Kai believe females make the best leaders because they have a natural tendency toward the nurturing arts."

"Really?" Danetta glanced up at the B-B surrogate CEO. "Then why would Zarber choose a male chief? He has quite a few female staff members."

"But they're all in subordinate roles. Besides, he probably accepted the obvious evidence that the Eldest was a male. I have it on good authority that that's a fairly rare occurrence. The last Eldest was female. About 60 percent of the other chieftains are female and so are a majority of the Shaman."

Danetta nodded. "How important is the shaman?"

"A lot more important than Zarber seems to think. . . . I hope."

"Could he be right? Is approaching

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the Eldest 'man to man,' as it were, a good tactic?"

"He could be right. My intuition says not, but—" He shrugged. "Even if this Eldest feels personally more comfortable negotiating with another male, he'll be more respectful of a female. Maybe even a little in awe of her."

"Ah. Six of one, half-dozen of the other. I could be an advantage or a break-even . . . or a disadvantage."

"I doubt that. For one thing you're older than Zarber's assistant."

Danetta grimaced. "You had to remind me."

"No, no. I mean, that's a real advantage. An older chief is a more experienced chief—a more colorful chief. That's why the oldest clan chieftain is automatically made the tribal leader."

Danetta turned back to observe the subjects under discussion. "OK. Let's see how I do with the great Chief," she said, and waited for a break in the conversation between chieftain and charlatan.

She did fine, all things considered, but the Eldest seemed more threatened by the Tanaka CEO than awed by her. Since the chieftain in line to take his position, if his health failed, was a middle-aged matron of the Lupao Clan, that was understandable. He was obviously more comfortable with the youth and inexperience of Zarber's Chieflet, Rhys suspected, because he could treat him with fatherly condescension.

It didn't help that Shaman Zarber dropped not-so-subtle hints throughout the feast that Rhys had somehow been responsible for his mishap earlier in the day. He implied that the rivalry between them was more than just simple competition over a contract (Rhys now knew the truth of that). His insinuations brought to Rhys's mind a vivid picture of two ancient tribal Magi, slinging curses and lightning bolts at each other through all eternity. It was like something out of one of those holographic role-playing games that seemed to be the constant rage among teenagers.

The Eldest seemed impressed with Zarber's macabre little remarks, but Pa-Lili was openly disdainful. "This Shaman Tsar-Bar is a rude fellow," she said, echoing Yoshi's sentiments. "Such slithering accusations are beneath a Shaman's breath. What sort of training did he receive? What feathers has he earned?"

"Well, actually," said Rhys, "he has, er, earned feathers in, ah, Business Thinking and Speaking of Diplomacy."

"Business?" tooted Pa-Lili. "What does a Shaman have to do with business? A Shaman is a caretaker, a preserver. It is a shame my Eldest is so taken with their freshly hatched Chieftain. But the Old One loves those he can impress. Your Chief Tanaka is too impressive to be impressed. . . . Perhaps you should lay a curse on this Shaman since he seems to believe you already have." She gave Rhys a hard look.

He shook his head, making his crest of orange fingers bounce and wave. "I couldn't do that."

"You have the means," she pressed, her gaze becoming conspiratorial.

He wondered if he was being tested. "Perhaps I do, but it would be . . . a great sin."

Pa-Lili nodded. "True, it is not good to wish others ill. But it is an equally great sin to lie." She looked pointedly

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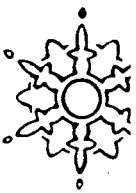

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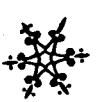

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at Zarber. "You had nothing to do with his toothlessness."

No, Rhys thought, I didn't. But if an accident pulled one fang, I sure wish I could pull the other.

In his dreams, Rhys Llewellyn was Myrddin. Powerful, he was, and ancient and hoary with green-ice eyes and a great ground-sweeping beard. He was pitted against a sinister black-clad figure that was part Mordred, part Dracula, and preponderantly Vladimir Zarber.

They hurled spells at each other. Zarber's magics were flashes of ruddy fire that fell to the ground, sizzling, to become horrid black lumps of living ooze. They moved, rippled like dying slugs and then began to crawl inexorably toward their target. Rhys parried them with blazing balls of white light and desperately prayed he could win the battle without drawing on the bottomless pit of black magic the Adversary was sucking up.

Somewhere in the morass of pulsing, claustrophobic dark and blood-flame, he seized upon the idea that he was fighting not one, but two Adversaries: Zarber/Mordred and the darker side of Rhys/Myrddin. He indulged in that briefly; the ancient allegory of light on dark, the rationale of deeply buried evils and cinder-core morals, then he put an abrupt stop to it.

No, he thought. Stop that. That's not me. I'm not tempted to use Black Magic, I only think I should be. I've no intention of changing my nature. None! And, like a petulant playwright, Rhys Llewellyn appeared from behind the dream proscenium and rewrote the scene. The "Tempting of Myrddin" was replaced with a straightforward duel to the death.

He awoke in a barrage of blood-red magic and lay sweating and wondering if he knew enough White Magic to save Arthur Pendragon's kingdom . . . or was that Danetta Price's company?

Oh, hell! he thought, his head throbbing with suddenly acknowledged pain. Go soak your ego. It's not even the company; it's just a damn contract! An important contract, though, he had to admit. If it wasn't important, Danetta Price would still be on Jamal.

Plagued by dour images of nice guys finishing dead last, he pondered his alternatives and wondered why, in human history, it seemed that, by and large, ethical businessmen had to struggle against being sucked into the undertow generated by their less scrupulous (and often more successful) competitors. Why did it rarely (except perhaps in the presence of an Avator) work the other way around? Why couldn't the good apples cause the bad ones to bob to the top of the barrel?

His mind foundered on the mixture of metaphors, making his headache seem suddenly much worse. He got up and groped for the medicine dispenser at the back of the bunk-side unit. His hands collided with the little pile of fetishes, talismans, and herbal concoctions Pa-Lili had given him during his last visit. He growled irritably and gathered them up, intending to put them away in his sporran.

"Light," he said, and the cabin's VA dimmer obeyed immediately. He was tucking the little pouches and vials away into the various pockets when he remembered that one of them was sup-

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posed to be a headache remedy. He peered into the bag.

"OK, Alice. Is it the mushroom, the cookie, or the small bottle?"

It was a small purple bottle. He studied it momentarily, recalled the three word incantation that was supposed to accompany the administration of the cure, and put three droplets onto his tongue. He grimaced. If it didn't work any better than it tasted, he was in for a bad night.

He called out the light and rolled back onto his bunk, quite literally falling asleep before his head hit the pillow. His remaining dreams were decidedly more positive.

"You're awfully perky this morning." Danetta Price studied Rhys's glowing face curiously. "Nice dreams?"

"After I took one of Pa-Lili's herbal cures. Before that, I was having nightmares."

Danetta raised ash-blonde brows. "What about?"

Rhys nearly blushed, recalling his grandiose self-image. "I guess it boils down to a fear that I was going to have to become a Zarber clone in order to compete with him."

Danetta nearly choked on her coffee. "God forbid!" She glanced at him sharply. "Do you think that's necessary?"

"No, I don't."

"Good," she said, but continued to look at him, eyes looking for some discrepancy between word and manner. "Are you sure?"

He smiled at her. "Absolutely. Why should *I* change to accomodate *him?*"

She shook her head. "You have a funny look on your face."

Rhys laughed. "You knew I had a funny-looking face when you hired me."

"That's not what I meant," she started to say, but was interrupted by the arrival of Rhys's apprentices, already decked out in their Pa-Kai finery.

Rhys steered the conversation to the negotiations. "The key to success here is flexibility," he said. "We need to be ready to react both to the Pa-Kai and Zarber, but not *appear* to be reacting to Zarber at all. The last thing we need is for this to degenerate into one-upmanship between Tanaka and Bristol-Benz. Zarber is used to dealing with people who are as wily as he is. The Pa-Kai are—"

"Simple?" suggested Rick, munching a fruit bar.

"No, *not* simple." Rhys suspected he was wearing what Hi-Pok had called his "Teacher Face." "You can't assume simplicity, Roddy. I don't even think you can make a good case for naiveté. They're . . . honest. Honesty is highly regarded among the Pa-Kai. So, we have to be honest. To a fault." He pressed the plastic table top with his fist.

"Zarber isn't going to be honest," observed Rick.

"Zarber also thinks the Pa-Kai are simple and he'll probably offer them trinkets and beads."

"Excuse me?" said Yoshi.

"When white settlers first met the Native Americans, they assumed them to be simple savages. When the Indian held out his hand in friendship, the white man put a trinket into it. That's pretty much been the dominant society's

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track record in inter-cultural relations ever since. When asked for friendship, we offer useless *things*." Rhys shook his head. "Sorry, I'm lecturing again. Old habits die hard. Anyway, who knows? Maybe the Pa-Kai will bring out the best in old Vladimir."

"Huh!" snorted Rick.

"What are *we* going to offer them that won't seem like trinkets?" asked Danetta.

"Returns on their investment. We sell them super-latex products for the stuff from which super-latex is made."

"Ah," said Rick. "Simple and elegant. And we already know that certain, colorful super-latex products are very much in demand in this part of Pa-Loana." He tweaked his own verdant green waterproof cockscomb.

"And if Zarber offers them more?" asked Danetta.

"We offer to show them how to manufacture their own super-latex products."

"That would eventually make them independent of our production facilities."

Rhys nodded. "It might eventually put them in competition with our production facilities . . . or in cooperation, which is more likely, given the Pa-Kai nature."

"You're putting a lot of trust in Pa-Kai nature," observed Danetta. "Do you think that's wise?"

"If I didn't—"

She nodded. "You wouldn't be doing it. . . . You seem very sure of yourself."

"Of myself. . . ? I guess I am." Rhys shrugged and sipped his coffee, wondering how long that would last.

*, * *

The Tanaka banner waved gently in the breeze that lapped at the Council Tent and spiraled around its brace. Danetta Price looked as elegant as any human could in Pa-Kai clothing. Her shaman and his apprentices looked smart and shamanly and her pallet was decorated with embellishments of Tanaka manufacture: Super-latex gloves for work in water, weather, and zero atmosphere, a boot or two for equally extreme environs. It was a tasteful display of a tiny part of Tanaka's product line and it was obviously of interest to the Pa-Kai. So were Pa-Lili's new cape and unisuit, also latex-derived. Rhys thought it quite auspicious that she'd worn them today.

Just as he was beginning to relax, a trumpet sounded (at least he thought it was a trumpet) and through the wide entry came the Bristol-Benz train. And it was a *train*.

The B-B "Chieftain" entered first, flanked by a smug Vladimir Zarber. The chief was not riding his pallet, but limping courageously along with a tragic expression on his face. He was dressed every bit as elegantly as any other chieftain in the tent and Zarber was made up in shamanly splendor, his black unisuit over-laid with a stole of bright fuchsia. Behind him came the standard bearer, waving aloft the Bristol-Benz logo—two bright red stylized interlocked Bs rampant on a purple field.

Behind the standard bearer marched every assistant Zarber possessed and, very probably, every member of his shuttle's flight crew. Four of them carried their chieftain's pallet, which was gaudily attired in every ambient color known to man.

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Rhys grimaced. Zarber was as good as his word; he was obviously prepared to play what he perceived was the Tanaka game, and to play it well—right down to making a stunning entrance. He settled in to his pillows and smiled at Rhys toothily.

"Shuttle medical unit not working," asked Rhys sotto voce, "or are you promoting missing incisors as a new fashion trend?"

Zarbers's sleek, black brows winged upward with batlike grace. "Why Llewellyn, that was a slight worthy of me. The med-unit is working fine, thank you, I simply couldn't find the tooth. I don't suppose you saw where it went?"

"Do you think I'd tell you?"

Zarber gave him a scathing glance that said, "O thou idiot." What he actually said was, "Yes, I do. But it's all right. I still have enough teeth left to chew you to bits."

Rhys faced front hastily, ostensibly to give his attention to Pa-Lili's opening chant, but his innards felt like a chilled pudding. He cursed the fact that Vladimir Zarber could make him react that way and tried to relax his grip on the spirit bag that hung from his necklace.

"Uh . . . sir?" Yoshi Umeki was leaning toward him from her position on his right hand. "Sir, you . . . you have a spot, sir," she whispered. "On your suit, sir."

He glanced down at the stain that spread across the front of his unisuit. "Oh, uh, I guess I was a clumsier than I thought at breakfast." He let go of the spirit bag. It hit his chest with a moist thump, then dangled in the perfect position to hide the stain. "There, that ought to cover it." He gave Yoshi a reassuring smile, then turned to throw one over his shoulder at Danetta Price.

Pa-Lili finished her chanting. "The Great Being is now attending our discourses," she informed the assemblage. "We may begin."

The Eldest spoke. "Now that we are gathered like to like, the speaking after foon may proceed. Tell us what good is foon, that you wish to have it." He gestured at Pa-Lili, who spun twice, then hunkered down to point at Zarber.

"You," she fluted. "Speak of foon."

Just once, thought Rhys, gritting his teeth. Just once let going first *not* be the advantage he always makes it. Just once, let him be hoist on his own petard.

Zarber rose and made a sweeping bow—his concession to a shamanly caper. "Foon," he said lugubriously, "is a small thing (very small, said his fingers) from which we make a stretchy fabric which some people (he made the "I speak of silly things" face and a muted gesture) like to wear. We sell them these shiny, stretchy things (of no import) and so we seek foon, which is so plentiful (and disagreeable) here."

Rhys's lips curled. Belittling the importance of the resource. Next came the beads and trinkets.

"So, you say this foon is of little worth to you?" asked Pa-Lili.

"It is of some worth to those who wear it."

Pa-Lili stroked her new unisuit and made a thoughtful face. "Not worth a whole lot, huh?"

She actually *said* "huh" in such a human tone that Rhys laughed out loud. He turned it quickly into a cough, but

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caught the gleam of humor in Pa-Lili's bright eyes.

Zarber, meanwhile, disguised his own smirk behind a head wag that said, "Oh, a little—a little."

"Then why did you come all the way to Pa-Loana to speak of this (worth very little) subject? Star travel is very costly and so must be the time of your Chieftain." Here, she jutted her long jaw toward the surrogate CEO. "The time of *our* Chieftains is *very* precious."

Zarber stiffened visibly. He made a minute gesture of apology. "I did not mean to belittle the importance of foon. I only meant that it is not, ah . . ."

"Is foon important to you, Shaman Reeslooelen?" Pa-Lili asked abruptly.

"Very important. As you know, our clothing is largely made from it. Also medicinal supplies, survival equipment, and enjoyment things . . . equipment for games of sport. Wherever humans go and the environment is harsh, things made from foon are necessary to our survival. There are so many, many things we humans use that have (wonderful) foon in them." Rhys glanced sideways at Zarber. Liar, he thought.

"How say the Chiefs?" asked the Eldest in his dry-reed voice. His jaw designated the Bristol-Benz Chief as the first speaker.

The young man blinked dark, almond-shaped eyes and cleared his throat. He looked uncertain. He wasn't. "We find foon exactly important enough to come all the way to Pa-Loana to the Pa-Kai Council. We find it important enough to offer great wealth to you and your people." The words were issued with calm, quiet (and dignified) authority, leaving no question in Rhys's mind why he was Zarber's pick for the role of Chief.

"Great Wealth?" echoed the Eldest.

"Oh, wondrous wealth. Brilliantly colored wealth. Wealth such as you have never seen on Pa-Loana—" He stopped and glanced at Zarber, who was making a little cutting gesture at his own throat.

The Benz Chieftain cleared his throat again. "You will be pleased, I guarantee it."

"And you, Chief Tanaka?" The Eldest's chin pointed at Danetta.

"Yes. Foon is very important to us. Our clan manufactures products made with the essence of foon for billions of our fellow humans and for men from other worlds, as well."

"Worlds like Pa-Loana?"

Danetta smiled. "Some like, some unlike. But I must say, I've never met a people quite as colorful as yours."

The Eldest's crest rose proudly. "And do you also offer us Great Wealth, as does Chieftain Benz?"

"We are prepared to offer whatever we agree between us is a fair exchange of goods and services." She paused, then said, "I'm almost certain that what we regard as great wealth would seem trivial or foolish to such wise beings as the Pa-Kai."

Rhys heard Zarber chortle under his breath. No matter, the Eldest was pleased by the comment, as the slight bobbing of his crest clearly indicated. Zarber could chuckle all he wanted. Bring on the baubles, thought Rhys. Bring out your dark magics and your thunderings and your spirit bag of gizmos. I'm ready for you, Mordred. . . . I hope.

The negotiations began in earnest

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then, with Bristol-Benz being accorded first volley. At the arch nod of his pseudo-Chief, Zarber laid out a veritable hors d'oeuvres tray of exotic foods and goods from all over the known Galaxy. The Pa-Kai tootled questions about this and that, and nodded, and made various faces of surprise and excitement and curiosity.

It was then Tanaka's turn. Danetta made a sweeping gesture to Rhys, but her eyes were on the Eldest and a wide, gracious smile played across her lips. Rhys then made his offer: such products of foon as the Pa-Kai desired would be available to the Pa-Kai merchants in perpetuity. As long as there was foon, they could have the product of foon.

Zarber stared at Rhys, dumbfounded Then he smiled (nearly grinned). "Is that all?" he asked regally.

"That is our opening offer," said Rhys. "You may make a counteroffer if you wish."

"I doubt that will be necessary." Zarber turned to Pa-Lili. "Do you wish to hear a counteroffer?"

"Do you wish to have the foon?"

Zarber turned a lovely shade of crimson. "I meant only, is there a need? We are offering so much more—"

"Yes, so it would seem. Let us hear your counteroffer."

Zarber nodded as if he had just seen a pattern emerging from a broken piece of ancient pottery. "Of course," he said and proceeded to replace the hors d'oeuvres tray with a smorgasbord of exotic items, entertainments and technologies. Enough junk to put the Pa-Kai through what would make the sufferings of Earth's aboriginal peoples at the hands of their more "civilized" brethren look like a kiddie story.

Rhys gritted his teeth and felt grey and husklike as he watched the Pa-Kai react to the descriptions of this entertainment or that technology like children hearing their first news of a carnival. With their simple way of life it must all sound like the play of gods, he thought. Ground cars and trundle-buggies, synth-ovens the size of a melon that brought forth an amazing variety of hot, ready-to-eat food, discams the size of a cup with which you could take three dimensional images of your loved ones (why bother going to the Clan artists for portraits?).

Yessir, thought Rhys, there's enough in that offer to devastate the environment, destabilize the economy and completely undermine the balance of power among the Pa-Kai for ever and ever, amen. Not to mention what it would mean to the other peoples of Pa-Loana to have such suddenly wealthy neighbors.

It took everything he had to generate the enthusiasm he had once felt for his own counter counter. He smiled, he made his gestures big and broad and encompassing, he even twirled and capered as he offered the Pa-Kai one technology: the simplest, most basic method of refining foon and using it to produce the products of their choice for themselves and for barter with other peoples. "You could then," he explained to the assembled Pa-Kai, "even sell the refined foon—the super-latex—to the Tanaka Clan, as well as the raw stuff. You might be able, someday, to barter the finished goods for sale on other worlds. You might even, someday, be

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able to receive the goods those worlds had to offer."

The Pa-Kai nodded and hooted and cooed, but they showed none of the childlike excitement they had evinced over Zarber's offer. While the Tribal Council considered the offers in the privacy of their voluminous tent, Rhys stood outside in Pa-Loana's fresh fragrance and felt something roughly the size and shape of the proverbial millstone settle in the pit of his stomach. He looked up at the pale, violet-blue sky overhead (and through it and past it) and thought, Was it too much to ask that today White Magic might win one? Was it too much to hope that the spirits of the Pa-Kai would be stronger than the technologies of the human? He heard an abrasive sound behind him and cringed.

"Foon-derived products in perpetuity?" chuckled Zarber. "Really, Llewellyn. What do you take these people for? They may be simple-minded, but they're not fools. I'm offering them tomorrow and you're bargaining with nuts and berries."

"But whose tomorrow are you offering them, Zarber—theirs or ours?"

"Ah, that must be the philosopher in you speaking . . . or perhaps the theologian—more concerned with musty ideologies than solid realities." He glanced across Rhys to Danetta. "An academic to the core, isn't he, Ms. Price? But then, you knew that when you hired him." His eyes moved back to Rhys, faintly pitying. "I'm winning this one on points, Professor. If you start packing now, you can leave in time to avoid the humiliation." He turned and strode away, his purple cape billowing behind him in the breeze.

Rhys felt Danetta's hand on his shoulder. "Don't let him get to you," she told him. "In a situation like this I'd take your philosophy over his any day of the millenium."

"But he's right, you know. He has won on points. The Pa-Kai were in conniptions over his offer. I just can't conscionably make them that kind of a bid. It would be like giving them Pandora's box—without the user's manual."

"I understand. Notice that I'm not pressuring you to sell them the Moon—or its man-made equivalent. This is a big deal, Rhys. A very big deal. I don't like the idea that we may have to depend on Bristol-Benz for our supply of foon—super-latex, or whatever. But, well . . . you're the professor." She tucked a lock of just-going-grey and gold hair back up under her headdress, and crooked a finger at Rhys's apprentices. "Come, children. Let's get back to work. I see by Pa-Lili's urgent gestures that they're ready to start."

The trouble with the Pa-Kai, Rhys decided, worrying his spirit bag and gazing moodily into space, was that they were so expressive. As a negotiator he was used to sitting opposite poker faces of every description, but the Pa-Kai, with their encyclopedia of facial expressions and gestures, were quite disturbing. They were obviously a joy to Zarber, who could read his success on their faces, but for Rhys it was hard to maintain his own facade of self-confidence.

An ancestor of his might have conversed with Zarber at knife point and forced him to own his lies. But then,

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an ancestor of Zarber's would have simply turned into a bat and taken Rhys's ancestor out for lunch. Ah, but if *Myrddin* had been one of Rhys Llewellyn's forebears. . . .

Rhys snapped to attention as the Eldest and his train entered the tent. He studied them for some encouraging sign, but saw none. Pa-Lili didn't even glance his way.

When all were seated, the Pa-Kai Shaman stood before her Chief, facing the humans across the Council Circle. "We have pondered and come to a (pleasing to us) decision."

"And quickly, too, I must say," murmured Zarber, just loud enough for Rhys to hear.

"We thank the Shaman Zarber very much for his Great Wealth offer, and accept . . ." The violet eyes moved to Rhys's face. ". . . the offer of the Tanaka Eldest and her vivid Shaman."

"What?" Zarber was, to all appearances, thrown beyond stunned into shock.

Rhys was thrown for a loop. Grinning from ear to ear, he capered and twirled in quite sincere abandon, then returned to his seat, beaming at Danetta, who gave him a "thumbs up."

"You have made us most radiant," he said. "Your wondrous colors overwhelm us."

Pa-Lili gestured that this was understandable, then turned to a now coolly fuming Vladimir Zarber. "Thank you for coming," she said in musically-accented Standard. "It has been interesting."

"I don't understand!" The words burst from Zarber's mouth as if he couldn't control them. He shifted quickly back to Pa-Kai. "Our offer was vastly superior to theirs."

"We did not see this," returned Pa-Lili in Pa-Kai. "It was your eye problem."

"My—? No, friend, it is *your* eye problem. The making-stuff things and foods and playthings we offered are worth much more than what this—this shaman has offered."

"To you, perhaps. Not to the Pa-Kai." Pa-Lili stared down her long nose at him. "Please, you must go. We have things (many) to discuss with the Tanaka Eldest and Shaman Reeslooelen."

Zarber blinked and gaped as if Pa-Lili's words were incomprehensible to him. Behind and around him, his "Chieftain" and the rest of his team echoed the expression.

Rhys was struck with a sudden childhood memory of viewing a school of groupers through the glass window of the sea-quarium in the Earth habitat on Jamal. He burst out laughing. Zarber ceased making fish faces and herded his entourage out of the tent.

What followed was half celebration, half negotiation. The Pa-Kai would receive catalogues of latex-derived products and the knowledge and training to help them produce products of their own. As an added bonus, Pa-Lili requested that books on human shamanistic practices and magics be translated into Pa-Kai. Danetta deferred to Rhys on that point and he cheerfully agreed to make sure the translations were done.

The negoti-bration went on into the early evening, ending only when someone noted that it was dinner time. The assemblage quickly dispersed to prepare for the evening meal.

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Rhys expected that Zarber would have flown off without so much as a snarl or hiss. He was surprised to find that gentleman waiting for him as he strolled the short path to the Tanaka shuttles.

"Well, Vladimir! Is this where you thump me over the head in revenge for some imagined wrong, or where you tell me you've learned your lesson and are going to turn over a new rock?"

"Cute, Llewellyn. Very cute. But actually, you're half right. I came to congratulate you on a well-played match and to say, I suppose, that you would seem to be right—honesty is sometimes the best policy."

Rhys was sincerely astonished. "I'm—astounded, Vladimir. Thank you."

"Hmmm." Zarber grimaced slightly. "I hate to admit it, but I learned something from you this week."

"Oh?"

"I learned that you can't judge a culture by its trappings. These Pa-Kai were . . . not what I expected them to be."

"Simple, but greedy, and easily bowled over by human technology?"

"Something like that. I have to admit, your line of expertise can be quite useful—given the right set of circumstances, of course."

"Of course. . . . Does this mean you're planning to study cultural anthropology?"

"Good God, no!" If Zarber's nose had wrinkled any more, Rhys was sure it would have shattered. "It means I'm going to confine myself to dealing with Benz's more . . . sophisticated prospects."

"Oh. Keeping out of my way, then?"

"Don't flatter yourself too much, Llewellyn. This is just not my métier—dressing up like a circus clown's nightmare, gavotting about and flapping my arms like some idiot fowl. I felt like an utter fool."

Rhys laughed. He laughed so hard he couldn't muster breath to tell Zarber it was his wild description of his very decorous behavior, and not his humiliation, that was so amusing. He grabbed Zarber's hand and pumped it, finally choking out, "Believe me, Vladimir, it looked like you never broke out of a waltz."

Several days later, as the remaining Tanaka shuttle prepared to take flight on a return voyage, Rhys made a point of giving his farewells to Pa-Lili.

"I have to ask you," Rhys said tentatively, "why you chose our offer over Bristol-Benz's. What they were bargaining with really was worth more."

"Not to us, Reeslooelen. This is not (your) Homeworld, nor is it Planet of Human Origin, nor is it any other planet of your acquaintance. You know this. And as your Chieftain rightly expected, we were not impressed with Clan Benz's many making-stuff things or their play-things or their food stuff. Their food stuff would make Pa-Kai stomachs hurt, while your growing-things package will give us foods from Pa-Loana soil. And as for his 'tek-now-low-gis,' " she stumbled distastefully over the word, "we will not want them until we can understand them. What we wanted, you offered—the knowledge that something we thought useless is not, that it can become the most colorful of things. *We*

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will learn how to make our own colorful and useful things. This way, it will be *our* tek-now-low-gi."

She made the "I am fat and content" face and gesture, folding her long hands over her stomach. She squinted her eyes at him. "We were not impressed with Tsar-Bar's manner. His gestures—so small, so uncertain. It isn't nice to judge someone by their gestures, but—" She shrugged eloquently. "I'm only Pa-Kai, after all. . . . He lies, you know," she added in a confidential undertone. "He is not a Shaman. He is a sham. And so is his puppy Chieftain. The Eldest met with them privately to admonish them not to wear adult colors until they are full-grown. Such childishness!" She made a dismissive gesture.

"You knew he was lying," Rhys marveled. "How?"

"The spirits told me. They made him give himself away with glances and speak disrespectfully to his so-called Chieftain during the Trade Speaking. I distinctly saw him tell his Chieftain to shut up!" She made the throat-cutting gesture, then shrugged in that uniquely Pa-Kai way that made Rhys wonder what their bones were made of.

"The spirits told you," he repeated.

Pa-Lili waggled her head. "There is one-reason," she admitted. "We liked you better." She put her face close to his and lowered her voice. "Do you know what Tsar-Bar reminded us of? There is a small animal in the northern forests that likes to suck Pa-Kai blood. *That* is what he reminds us of." She shivered and made several gestures of distaste.

Rhys laughed and walked with her to the Tanaka shuttle's passenger ramp.

"It has been good to know you, Rees-looelen," she told him, her violet eyes misting. "You will come back?"

Rhys looked around and saw a fair land inhabited by fair people. A veritable paradise. "You couldn't keep me away. I have a vacation coming up. I think I'd like to spend it here."

Pa-Lili nodded. "I would be pleased. And you will bring me books of Human Magic?"

Rhys smiled. "I'll translate them myself. But I don't expect you'll learn anything from them you don't already know."

"Oh," said Pa-Lili, making a wise face, "one learns new tricks from unexpected teachers."

"One does, indeed."

"You know," she said, eyeing him judiciously, "you are a very good Shaman. Your routines are a little dull, but your magic is very sound, very colorful. When you come back, I will teach you how to present your case more eloquently. Your gestures are pretty good, but your capers and twirls could use some work."

Rhys bowed, nearly sweeping the ground with his headdress. "I would be honored to receive your (excellent) instruction." He straightened, then, and gave Pa-Lili's bony frame a solid hug. She responded so enthusiastically, she left him winded.

Later, in his cabin, as the shuttle sped toward Jamal, he chuckled over Pa-Lili's parting shot. He'd definitely have to work on those capers. He tried one, nearly upending in the diminished gravity, and laughed, feeling quite as light within as without.

He took off his cape and headdress

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and folded them away in a below-bunk receptacle, then stood, feeling the spirit bag thump lightly against his breast bone. He grinned, hefting its insubstantial weight in one hand. Pa-Lili was right, you did learn new tricks from unexpected teachers.

He pulled the little pocket of fabric open and emptied its contents into the palm of his hand. A shred of bright but brown-stained material, and a tooth, gleamed under the cabin's sham-sun lighting. Both went into a tiny, wooden fetish box which, in turn, Rhys tucked into an inside pocket of his sporran.

The spirit bag stayed where it was, on its long, vivid necklace. In human company he might tuck it away beneath the fabric of modern life, but he would keep it next to his heart. He was a good shaman.

He relaxed on the bunk and wondered how Vladimir Zarber was weathering his homeward flight. Maybe, he thought, maybe someday I'll tell him what happened to his tooth. . . . ■

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Jay Kay Klein's biolog

If you're just plain Mary Elaine in Nebraska and can't throw a stone without hitting another Mary E—somebody, Maya Kaathryn is a swell collection of letters for a rock singer and *Analog* author. Bohnhoff was taken from the band's flutist during a marriage ceremony.

As an army brat, Maya just happened at birth to be in Davis, CA. Her dad was a tech sergeant in the air force who had taken time out to study agronomy at a local college in preference to going to OCS. This trained farmer was then transferred to a desert base in Rabot, Morocco until Maya was five. She still sees the place whenever she reads *Dune*. Stateside posts included Offut Strategic Air Command near Omaha, NE. There, her older sister took off to try a career as a concert pianist. Mom had been a forties *torch singer in Hollywood*.

After Nam, dad chose SAC headquarters duty over the Pentagon. Maya became a full-fledged horse-crazy, football-cheerin', choir-singin' daughter of the corn belt. At fifteen she went back to California, got deep into music, discovered the Bahai faith, and dropped out of college to join a Bahai-oriented folk-rock band as a singer. A free wheeling California life-style lasted as long as the gigs did, and then a full-time job on the assembly line at an electronics plant, with small-time weekend gigs. A voracious reader, she had also been doodling word sketches since she was a child. She treated school writing assignments like a self-determined honors course.

Analog authors always have early reading and writing backgrounds, and nearly always a life-long love for SF. Along the way, there is always *lots* of practice writing. Writers are born; *authors are made. Maya turned out a giant* novel that didn't sell, then thought about writing until everything came together —plots meshed with techniques joined with characterization. Hard science for an *Analog* story was harder, but she had help from some good astronomy texts. She is most interested in exploring the "self" of her characters, fitting them into *their created worlds. As a Bahai adept*, she feels the future is there, ready for people to grasp and shape.

For Maya, writing is not an artisan's blacksmithing trade, but more of a mystical experience in visualizing and creating new existences. From someplace inside, her fingers take dictation to put words on paper. The fingers may be blacksmithing, but it is elemental fire that does the shaping. She follow's Ray Bradbury's advice to get the feelings down on paper and then goes back for the final word selection. First draft is longhand, followed by word-processing for a final edit onto a laser printer.

Writing is now full-time, with notebooks and writing pads always at hand, notwithstanding a 9-5 job designing software-training for computers. Stories are mostly SF, with some fantasy and probably a mystery or two coming up. A first *Analog* appearance was in "Brass Tacks," *just like Lester Del Rey and some other* authors. Then came "Hand-Me-Down Town" in Mid-Dec., 1989. Maya agrees with the assessment that non-SF, tagged "mainstream fiction," really is a self-limited subset of the greater universe of SF. As a science fiction writer, she can explore areas closed to more parochial writers. ■

Maya Kaathryn Bohnhoff

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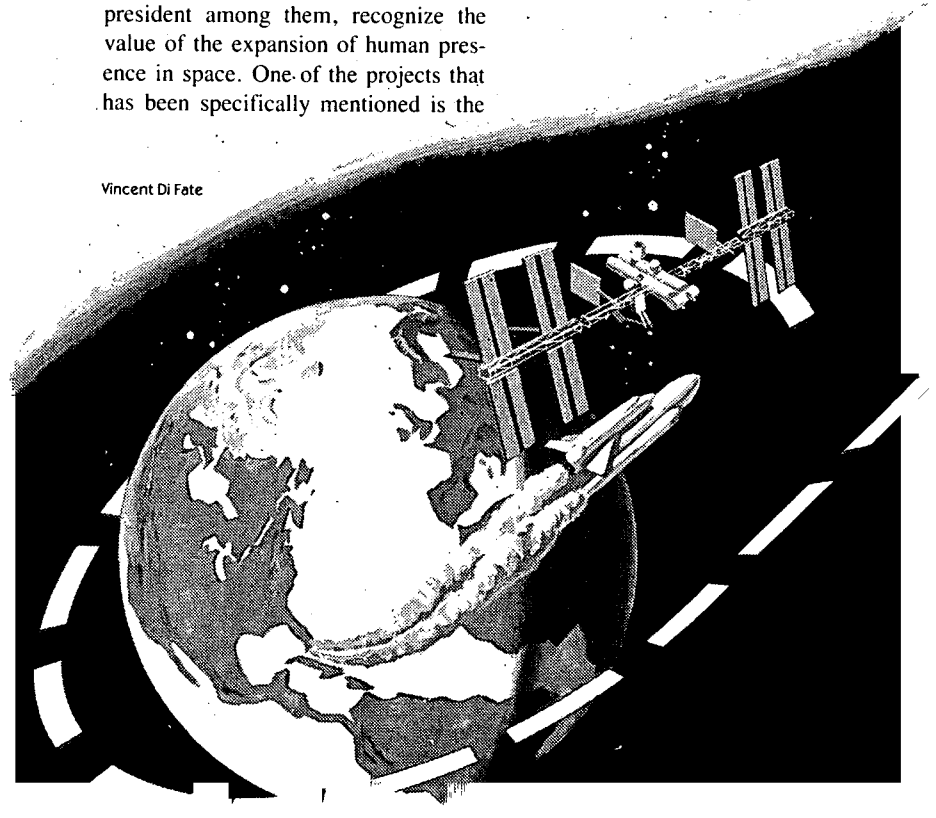
TAKING THE SHUTTLE TO THE MOON

Chris Vuille, Ph.D.

In the past year there has been some talk on Capitol Hill of renewing America's commitment to an ambitious program of manned spaceflights to the Moon and distant planets. While it is yet to be seen if such recommendations will make it into the yearly budget, it is encouraging that some of our national leaders, the president among them, recognize the value of the expansion of human presence in space. One of the projects that has been specifically mentioned is the establishment of a permanent base on the Moon with rotating personnel. That raises a number of questions, the most important one concerning the availability of launch vehicles capable of putting a sizable payload into lunar orbit.

After the last Apollo Moon shot in the early '70s and Skylab in '75, the



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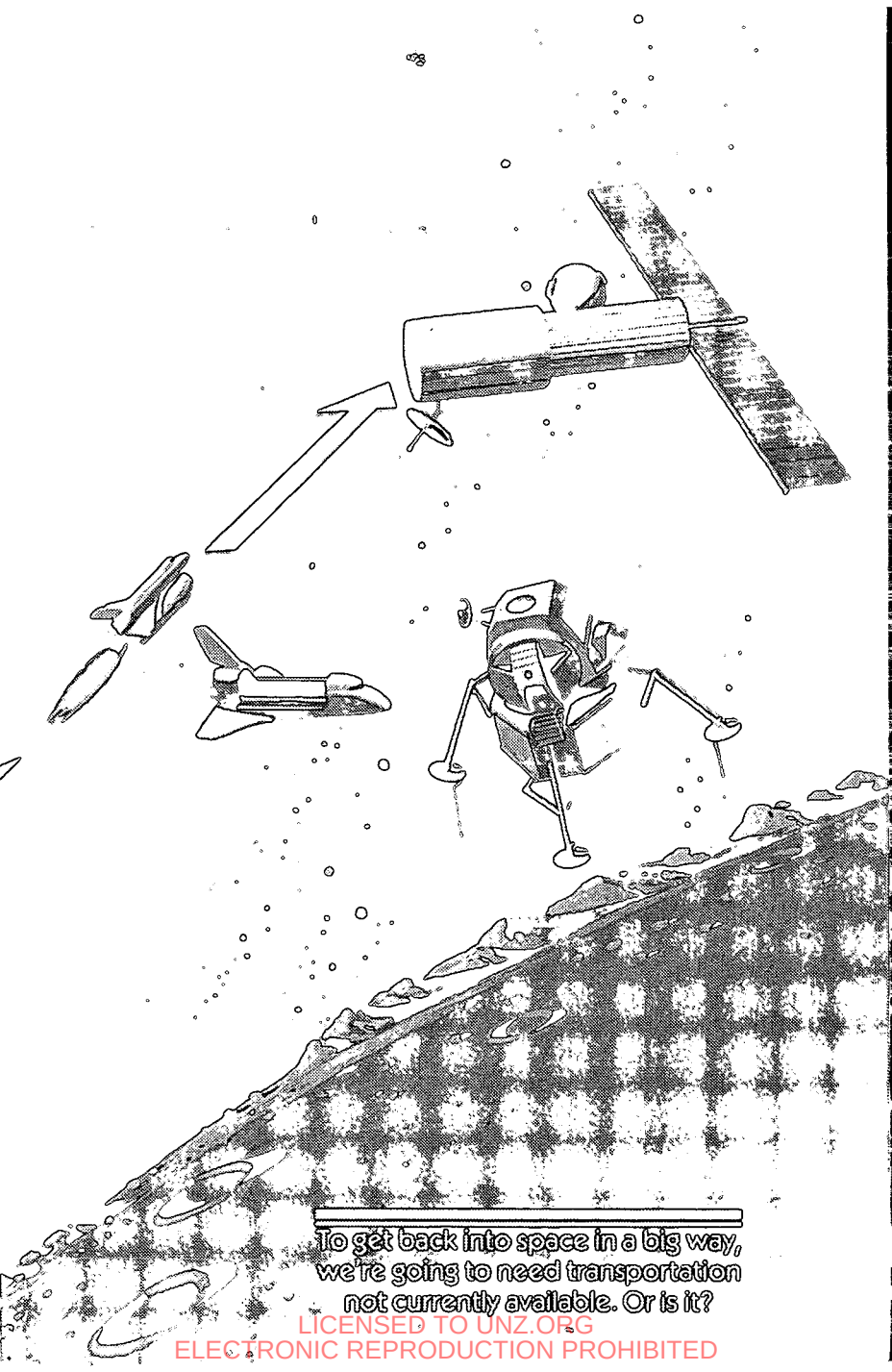

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rest of the Saturn hardware was mothballed, and in fact, some of the blueprints have since been lost. That means going back to the Moon in a Saturn may require redeveloping crucial parts of the rocket. There are several other rockets available, such as upgraded Delta and Titan boosters, and of course the shuttle, but these are limited to delivering payloads to various Earth orbits. For anything beyond that the payload has to be drastically reduced, which means that, at the moment, America no longer has a manned Moon launch capability.

The Saturn series of boosters were the evolutionary descendents of the German V-2s, the realization of Wehrner Von Braun's dream of massive, staged, interplanetary rockets. In many ways they represented the right kind of launch vehicles on which to base an ambitious program of expansion in space. The top-of-the-line model, the Saturn 5, was awesomely powerful. Fully assembled and fueled, it stood over one hundred meters tall and weighed in at around twenty-seven hundred metric tons. Its first stage burned kerosene and liquid oxygen, a safer, less volatile combination than the more powerful cryogenic hydrogen and oxygen mixtures. The first stage cluster of five F-1 engines delivered a total thrust of over thirty-three million newtons, which exceeds the total thrust of the space shuttle's solid and liquid fuel engines by about five million newtons. The second and third stages burned liquid hydrogen and oxygen (LOX). Mission flexibility was built in: the rocket could either deliver one hundred thousand kilograms into low Earth orbit (which is over three times the payload capacity of the shuttle), or send thirty-seven thousand kilograms to the Moon. Following an evolutionary approach to rocket design, as exemplified by the Saturn boosters, results in enhanced reliability, a tremendous plus in the dangerous business of space flight. The Soviet Union has pursued a policy of booster evolution for years, and as a result is in many ways far ahead of the US effort, particularly in the area of long-duration flight. Abandoning the Saturn class of rocket boosters was one of the great failures of US space policy.

The Space Shuttle, meanwhile, has not lived up to the goal of easy and cheap access to space. It costs several thousand dollars to get one kilogram of payload into orbit using the shuttle, which is not any better than the Saturn 5 performance of the previous decade. The corresponding Soviet boosters, on the other hand, do the job for several hundred, an order of magnitude less. The rule of thumb is that bigger rockets with bigger payloads bring down the cost per kilogram, mainly because it's a lot more efficient to prepare and launch one big rocket than several of smaller size. Scaling up to larger rockets doesn't necessarily increase complexity by the same factor, or the launch costs.

Nonetheless, the shuttle is America's only currently available manned space vehicle, and the bugs have been more or less ironed out. The big problem is that it's limited to Earth orbit, a far cry from the Moon. There exists a possibility, however, that its range could be

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extended, which could save billions of dollars in research and development costs. The idea would be to take an evolutionary approach based on existing shuttle technology, just as the Saturn series of rockets were ultimately derived from the V-2. The fact that it has already been thoroughly tested is highly advantageous, and further development ought to capitalize on that fact. When human lives and billions of dollars are on the line, reliability is the single most important factor in any spacecraft design, and this reliability can best be achieved through an evolutionary approach.

The shuttle can carry a crew of 7 on missions lasting as long as 30 days. Since the round-trip travel time to the Moon is about 10 days, this leaves 20 days for operations in the lunar environment. An inexpensive modification extending the range outside of Earth orbit would save money, time, and lives. There are two ways to extend that range without major design changes to the current shuttle configuration.

The first and most obvious way is to build bigger solid rocket boosters (SRBs), or strap on another pair, or both. Currently more powerful SRBs are under development in order to increase the shuttle payload, a plan which in fact has been condemned by NASA as introducing significant new risk for relatively little benefit. Using the original SRBs, a rough calculation yields the estimate that strapping on about two additional boosters would come close to providing the Δv needed to put the shuttle into a translunar injection. The attractive aspect of this plan is that the boosters are already available, and necessary modifications would appear slight, at least at first glance. The main objection is that any change to the status quo introduces additional uncertainty. The boosters are enormously powerful, each one creating 11,500,000 newtons of thrust. At ignition, the internal pressures are so great that the metal casings actually expand like balloons, cinched in at each joint. Strapping on more boosters, such as the Russians do with some of their rockets, could result in significantly increased stresses on the airframe, not to mention the gee forces on the astronauts. The roll maneuver in the first few seconds of flight is effected primarily to reduce the aerodynamic stress; no doubt this maneuver would be far less effective with another 23,000,000 newtons of thrust on line. It's likely the entire assembly of external tank, boosters, and orbiter would have to be reevaluated and redesigned. A new solid-fuel booster, or set of strap-on boosters, means a new set of variables, increasing the probability of another *Challenger* disaster.

Fortunately, there is another possibility, which is to refuel the shuttle in orbit. In this plan, the shuttle takes off from Canaveral en route to a rendezvous with the planned US space station. Taking on additional fuel, either by refilling the external tank or by attaching a fresh fuel tank, it again fires its main engines and embarks for the Moon. Design-wise, this option is superior to that of attaching additional SRBs, since the modifications would be minimal and there would be no increased aerodynamic stresses (except the heat of reen-

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try—see below). Refueling in orbit would be safer than the original fueling process on Earth, since the vacuum of space would effectively reduce the possibility of premature ignition of the liquid hydrogen. The main question is whether or not another eight minutes or less of fire from the shuttle main engines could produce sufficient Δv to enable a translunar injection. This question can be answered with a relatively simple back-of-the-envelope calculation, which will be given in detail below.

The shuttle reaches Earth orbit with virtually empty tanks. It is necessary to calculate approximately how much more fuel would be required to obtain a successful injection onto a lunar trajectory. Let's assume that the shuttle is initially in a circular orbit 400 kilometers above the Earth, which is the limit of its current range. Since in a circular orbit the gravitational acceleration of the Earth provides the centripetal force that keeps the shuttle in its orbit, it follows that

(1) $$\frac{v_c^2}{r} = \frac{GM}{r^2}$$

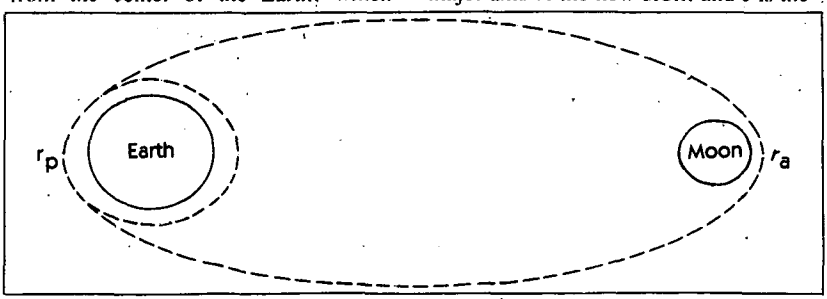
where G is the constant of gravitation, about $6.67 \times 10^{-11}\ kg^{-1} = {}^{-}m^3 - s^{-2}$, M the mass of the Earth, about 5.98×10^{24} kilograms, r the radial distance from the center of the Earth, which would be 6,378,000 meters plus the four hundred thousand meters above the Earth's surface, and v_c the velocity of the shuttle. Plugging in the numbers gives the velocity of the shuttle in a circular orbit 400 kilometers above the Earth:

(2) $v_c = 7{,}673$ meters per second.

In this orbit, the shuttle engines must be fired in such a way as to create an elliptical orbit with perigee r_p at 400 kilometers and apogee r_a at 384,000 kilometers, which is the mean orbital distance of the Moon (see the figure). Firing the engines tangentially to the direction of motion in Earth orbit will automatically put the shuttle into such an ellipse, with the distance to Earth at that point of firing becoming the perigee of the new orbit. The trick is getting the correct change in velocity. (An excellent source for the equations giving orbital transitions of various kinds is A.E. Roy's book, *Orbital Motion*.) The new velocity necessary for the elliptical orbit having perigee at 400 kilometers is given by the equation

(3) $$v_p = \left\{\frac{GM}{a}\,\frac{(1+e)}{(1-e)}\right\}^{1/2}$$

where v_p is the velocity needed at perigee of the new orbit, a is the semi-major axis of the new orbit, and e is the



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orbit's eccentricity. Fortunately, a and e can be found from two simple equations,

(4a) $a(1 + e) = r_a$, *and*

(4b) $a(1 - e) = r_p$,

where r_a is the distance from Earth at apogee and r_p is the distance from Earth at perigee. Solving these simultaneously results in $a = 195{,}389$ kilometers and $e = .9653$. Plugging these into equation (3) gives $v_p = 10{,}756$ meters per second. The necessary change in velocity is therefore

(5) $\Delta v = v_p - v_c \doteq 3{,}083$ *meters per second*

This is the amount by which the Shuttle's speed must be increased so as to enable it to enter into an ellipse with perigee 400 kilometers above the Earth and apogee at the Moon. The time required to go from perigee to apogee can be easily found from the equation for the period of the orbit, T, which is essentially Kepler's third law of planetary motion:

(6) $$T = \left(\frac{a^3}{GM}\right)^{1/2}$$

Putting in the numbers gives T = 239 hours, which is the round trip time. Half that is 119.5 hours, which is just under five days.

Approximately how much fuel would be required in order to obtain the desired Δv given by equation (5)? The answer to this question is of primary importance in determining the feasibility of the whole idea. A good first or second year physics student can derive the "rocket equation," which when integrated yields

(7) $$\Delta v = v_e l_n \left(\frac{m_o}{m}\right)$$

where v_e is the velocity of the exhaust gases relative the rocket, m_o is the original total mass of the vehicle, including fuel and payload, before beginning the maneuver, and m is the total mass of the vehicle when the engine stops firing. For m_o take the mass of the orbiter and payload and add it to the mass of the empty external fuel tank plus the mass of an unknown quantity of fuel, x. Denote the mass of the orbiter plus the empty fuel tank by m_s. Then equation (7) becomes

(8) $$\Delta v = v_e l_n \left(\frac{m_s + x}{m_s}\right)$$

The mass of the orbiter is 75,000 kilograms, that of the payload is 29,500 kilograms, while the empty external tank masses 35,400 kilograms. Adding these together gives an m_s of 139,900 kilograms. A conservative value for the vacuum exhaust velocity of a rocket engine burning liquid hydrogen and oxygen is $v_e = 4{,}000$ meters per second. Plug these numbers into equation (8), as well as the value of Δv found in equation (7). Solving equation (8) for x yields

(9) $x = 162{,}478$ kilograms of fuel.

Fully fueled, the external tank carries 616,500 kilograms of liquid oxygen and 102,000 kilograms of liquid hydrogen, for a total of 718,500 kilograms. Hence refueling the shuttle in orbit with about a quarter its usual load of fuel would extend its range all the way to the Moon!

The big snag in all this is the refueling plan, which would be easy to develop but costly to implement, especially with the boosters currently available. One of the options would be to refill the external tank from a supply already boosted into orbit. Another option could involve

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ejecting the external fuel tank and making rendezvous with a specially designed tank previously placed in orbit by another launch vehicle. The catch in either case is that lifting such a mass of fuel is going to be expensive, requiring several conventional launch vehicles. The new Titan 4s can put around twenty thousand kilograms of payload into low Earth orbit, which means about eight launches would be required. This would be both inefficient and very costly. Since the Titans are the most powerful rockets available other than the shuttle, there is no other choice but to develop a new booster to ferry the fuel up into orbit.

Again, dollars could be saved by using existing technology. A configuration involving a shuttle tank and upgraded strap-on boosters could do the job. Such SDVs (Shuttle-Derived-Vehicles) have been under study for years. One configuration calls for exchanging the SRBs for LRBs (liquid rocket boosters), and replacing the orbiter with a large cargo module equipped with the usual array of shuttle main engines. The payload capability of this system would be about two hundred thousand kilograms, and hence could ferry all the needed extra fuel to orbit. Though additional research dollars would be needed to develop the LRBs, it would be money well spent, since it would increase shuttle safety during ascent (unlike the SRBs, LRBs can be shut down in an emergency). Using the proposed SDV and switching to the LRBs would allow a Moon shot consisting of a single tanker launch followed by a shuttle launch, with rendezvous in Earth orbit followed by a trip to the Moon. One of the nice aspects of this plan is that the danger to human life is kept essentially constant, since the major modifications involve the tanker, not the shuttle itself. The total cost for such a mission would probably be no more than three times that of a shuttle launch—call it on the order of seven hundred million dollars. But the point is, it could be done, and once the shuttle made rendezvous and refueled, the previous calculation shows it could make it to the Moon.

At the end of the five days of travel time between the Earth and the Moon, the shuttle's velocity would be relatively slow. At apogee it would be within the sphere of influence of the Moon, and getting into lunar orbit would be a simple matter of effecting a relatively short additional burn of its engines. Getting down to the lunar surface raises another problem. Since the Moon is airless, the shuttle would be unable to make a landing there as it does on the Earth, where it can glide down to an airstrip. It would be necessary to take along an additional shuttle craft similar to the one used on the Apollo missions. While there's plenty of room in the payload bay for LEM-type lunar modules, carrying landers along cuts down on the payload, so eventually it would be desirable to find an alternate solution, not to mention the fact that the LEMs didn't have a whole lot of landing leeway built into them. Their paper-thin metal walls were nearly see-through, and they had a very limited payload capability. Then there was their margin of error for landing and return,

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which was narrow at best. It would be better to plan on building a more durable vehicle for effecting the transfer of men, women, and supplies. Given the danger inherent in any excursion to the lunar surface, it would be a good idea to first build a space station in permanent lunar orbit to provide support both for the shuttle and the transfer vehicles. The tanker could be modified to boost the materials for this station to the Moon (though the payload would be considerably less than what it could deliver to low Earth orbit). Alternatively, the lunar space station could be constructed in Earth orbit and slowly boosted to the Moon using ion rockets. The oxygen fuel for the transfer craft could be mined on the Moon, which has large amounts of oxygen locked up in its minerals. Getting the oxygen out of the rock requires power, but that's abundant on the Moon in the form of solar energy during the lunar day. Hydrogen is another matter, thought to be in short supply, though it's possible there might be ice in the permanent shadows at the lunar poles, or even trapped in a layer a few hundred meters under the lunar crust. This could be mined and split electrolytically into hydrogen and oxygen. Another possible source of hydrogen is in the dust on the surface. The solar wind is composed primarily of ionized hydrogen, and over the aeons a significant amount of this hydrogen may have been deposited in the lunar soil. Reducing the oxygen and hydrogen to liquefied form is easier on the Moon than on Earth, particularly since in shadow the temperature plunges far below zero. An electromagnetic cannon, otherwise known as a rail gun, could be used to get fuel tanks into lunar orbit. Fuel obtained from the Moon, in addition to supplying the landers, could also be used to refuel the shuttle for the next round trip, or even to extend the range of an SDV beyond the Moon. Boosting fuel tankers up into lunar orbit would be at least an order of magnitude cheaper than boosting fuel from Earth once the system was in place, and would have to be a high priority in any plan involving the establishing of a permanent base, not only because of the obvious necessity for fuel, but also to provide oxygen and its dihydride, water, to the personnel on base.

Getting the shuttle back to Earth poses a different set of problems, with breaking out of lunar orbit being the least of them. The weakness of the lunar gravity field means that only a relatively small Δv is needed, so fuel requirements shouldn't pose much of a problem. Once out of the Moon's sphere of influence, Earth's gravity field does the rest, gradually pulling the spacecraft home and increasing its speed as it approaches. Course corrections are usually fairly minor in terms of fuel requirements, and for the most part could be handled by the shuttle's usual maneuvering system or by short bursts from the main engines.

The final problem consists of getting safely back down through the Earth's atmosphere. Ordinarily the shuttle reenters the atmosphere at about 27,500 kilometers per hour. On returning from the Moon, the shuttle's velocity would be

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close to 40,000 kilometers per hour, which is nearly escape velocity. This greater speed would create higher temperatures due to the friction of molecules of air against the shuttle skin on reentry. The brunt of this frictional heating is taken by the reinforced-carbon-carbon, or RCC, the black material on the shuttle's nose and on the leading edges of the wings. This material might have to be improved, and perhaps the ceramic tiles as well, or bolstered by supplementary systems. Additional cooling could be effected by a system of liquid metal (sodium) heat pipes, for example. Even in the event that such improvements were found to be too difficult to achieve or simply too expensive, there remain other options for effecting the necessary slowdown. One such option is aero-braking. By dipping into and out of the upper atmosphere, the shuttle could slow down sufficiently to allow normal reentry. The other option is to use the shuttle main engines to cut down on the speed prior to reentry, but this would be a last resort since it would require considerably more fuel, greatly increasing the cost of each mission to the Moon.

It would be desirable, however, for Moon-going shuttles to avoid returning to the surface of the Earth altogether. If engine refurbishment and refueling could be accomplished in orbit, then there would be no reason for the Moon-going shuttle to ever touch ground again. A combination of aero-braking and strategic engine thrusts could result in reestablishing the original circular orbit at four hundred kilometers. The idea would be to have one fleet of orbiters for the trip from Earth's surface to the space station in Earth orbit while another fleet remained permanently based in space, plying the space lanes between the Earth and the Moon. Implementing such a plan is virtually a necessity anyway if a permanent manned base on the Moon is to become a reality, particularly in the beginning while the base is under construction. With time, as the lunar colonists became more self-sufficient, the necessity of regular access would lessen.

With back-of-the-envelope calculations it has been demonstrated that though the United States no longer has any Saturn 5s, it still has the ability to reach the Moon with a modification of shuttle technology. Using proven technology for such missions is tremendously advantageous, both in terms of developmental cost and in terms of reliability. The design changes suggested here could probably be implemented within five years, depending on the level of national commitment (i.e., space budget). A fleet of ten shuttles, half based on Earth and the other half based permanently in space, could rapidly effect the exploration and colonization of the Moon. Shortly after the turn of the century, say by 2010, the lunar space station could be in place and the first lunar base operational. The total cost of such a project from its beginning to the end of construction of the lunar base, assuming it were done correctly, would probably approach four hundred billion dollars, which is actually a very reasonable sum when spread over fifteen or twenty years. The annual investment would be about two-thirds as large as

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the current yearly budget of the US military space program. Of course, once the base had been established there would be the cost of yearly maintenance which wouldn't go away, but at the same time the returns on the investment would start coming in. These returns would take many forms, the biggest being increased scientific knowledge leading to invaluable technological spin-offs. Further, there is the possibility of resource exploitation, though these resources would in fact be better used in developing lunar and near-Earth space facilities, which in turn would greatly reduce the yearly maintenance costs. But opening up a world having the surface area of Africa, with completely untapped resources, would constitute only a small fraction of this return. Of far greater value would be the incalculable intangible returns that always accompany exploration and discovery, and the enormous extension of knowledge that is created when human ingenuity is pushed to the limit.

Getting back to the Moon and learning to live there is the first step toward living on other planets. By comparison with the Moon, Mars is quite hospitable, and though conditions on Venus are in some ways worse than on the Moon there is the possibility of terra-forming the planet on a large scale. As mentioned earlier, SDVs refueling in lunar orbit could put sizable payloads en route to either Mars or Venus. The Moon becomes a stepping stone for expansion outward to the other planets, using nothing more sophisticated than shuttle-derived technology. But the bottom line is that none of this will come to pass unless a serious effort is made to get back to our nearest celestial neighbor, the Moon. One way to go about it, using shuttle techonology, has been outlined here. The only question that remains to be answered is whether or not this nation, or a group of nations, has the will and the vision to go for it. ■

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About the Author

Chris Vuille is currently a professor of physics at Embry-Riddle Aeronautical University in Daytona Beach, Florida. He holds bachelor's degrees in French and chemistry, dual master's degrees in applied and pure mathematics, and a Ph.D. in theoretical physics. His research interests encompass a variety of topics in gravitation, astrophysics, and mathematical physics. Recently, he completed a science fiction novel and is in search of a publisher. This is his first sale to *Analog*.

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Desperate circumstances often require desperate measures—but *this* gamble just might give new meaning to the phrase "long shot"!

BEN FRANKLIN'S LASER

Doug Beason

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I had seventy-five hours to save the world. Actually, it's the Solar System I was supposed to save. But that's splitting hairs. I didn't even volunteer.

A week ago the solar neutrino flux jumped by six orders of magnitude. The astrophysicists didn't have to convince StarCommand that it was statistically significant. You see, according to the latest "standard model," that meant our G-2 Sun was about to expand into a red giant, right before it collapsed into a white dwarf.

Which means a helium flash in seventy-five hours.

Translating for the non-scientist types, that means a runaway fusion explosion; crispy critters, big time.

I know, I know—Sol is supposed to be around for another five billion years and the transition to a red giant should take a hundred million years after that.

But a theory is just that, and I *won't* argue with the facts.

Reports poured in from StarCommand outposts from all around the Solar System. Everything confirmed the new predictions. It didn't look good.

The public had started to get a whiff of the news, but even StarComm's news blackout couldn't stop the leaks—the rioting had started and was sure to get worse. The only thing that could save us was a last-ditch, experimental effort.

So who did that leave us?

Me.

The outfit they dressed me in was too tight, too hot, too scratchy, and made of wool. That's the trouble with being kicked back five hundred years—you have to go native all the way.

Dr. Potiphor rapped on the window. "Ready?" His voice came over an intercom.

"Yeah." I hiked up my pants. I wasn't going totally native. I had the recall magnets, money, and recording gear hidden inside my belt. "Are you giving me a countdown or what?" I asked.

"Just relax. Once we've got the time locked in, it'll take awhile for the spatial coordinates and angular momentum to follow. We don't want you smeared over the countryside."

"Thanks. How much more time?"

Dr. Potiphor didn't answer.

Great. I prayed he got his decimal points right—I didn't want to end up in the center of some farmer's stone fence when I popped into the past. The time, position, and even angular momentum transfer had to be just right when I Jumped; otherwise, I might skid onto the ground, spinning near light-speed, if he miscalculated. I hated being a guinea pig, especially when they weren't certain it would even work. Still, I guess it was better than rolling over and playing dead to that imploding sphere.

Dr. Potiphor spoke up. "Doctor Grayson, the Jump sequence is converging . . ." he squinted at a holo floating next to his face. "Your return Jump is in seventy-two point oh four five hours, your time, whether you are ready or not. If your recall magnet isn't on . . ." he paused as I finished the sentence for him: he couldn't guarantee that I would be yanked back to this lab. I'd pop back to the present, but *where* was a different matter entirely—the way the probabilities worked, I could just as

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well appear at the bottom of the ocean as the lab. You're darned right I would ensure the recall magnet was on.

Supposedly, Jumping to the past is a lot like being attached to a rubber band. The farther back you go, the shorter time you can spend. Seventy-two hours wasn't a long time, but it was better than nothing.

Potiphor spoke again. "You've got the recording equipment switched on?"

I checked for the fifth time. "Right."

"Very well. Good luck."

Yeah, I'd need it. Who had ever thought it would work? I mean, starting the laser revolution three hundred years before lasers were even invented? It sounded nice and simple: allow Ben Franklin to invent the laser and let the technology cascade. Grow enough so that in five hundred years we'd have something to get us out of this mess.

I know it sounds crazy, but when you're grasping at straws, you've got to go all out.

That's what I get for being the only laser physicist in StarComm, a scientist in the midst of the military—never mind I didn't think we could ever change the past. But I'm the only one in StarComm who knew anything about lasers, so when they volunteered me, I agreed to go.

You can still see the two furrows from where they dragged me over to Dr. Potiphor's lab.

Dr. Potiphor interrupted my thoughts. "I've got a lock: June 20, 1752, Philadelphia, Pennsylvania. Dr. Grayson, good luck! Ready, ready . . . *now!*"

My stomach flipped and I was hit by a ton of water.

* * *

My lungs screamed for air, but I didn't dare open my mouth. I squinted through the water.

Light.

I clawed upward, out from the cloudiness and towards the sunshine diffusing through the liquid. *Did it work?*

Breaking through the surface, I coughed, trying to purge my lungs of water. I moved my arms and rotated around, taking in the view. It was a clear day. I could see none of the brown soot that filled the world I knew.

Treading water, I looked around and spotted a clump of trees by the bank. A stone bridge spanned the river in the distance. No one was around—I either hadn't been spotted or I had scared the hell out of everyone who might have seen me pop in.

I stroked for the bank but my wet clothes prevented me from making much headway. So I quit trying to swim and instead concentrated on dog paddling. Minutes later I finally touched bottom.

Dragging myself on shore, I struggled out of my clothes. I cracked open my belt and spilled its contents to the ground. The recall magnet and recording gear were wet but operable; the money and the letter of introduction StarComm had provided me with were dry inside a sealed plastic bag. Withdrawing several coins, I placed them in a money purse, restuffed the belt and pulled it tight around my waist. Now to get out of here.

After dressing, I surveyed the area. The only sound came from water running off me in rivulets. I had to have made it—the future wasn't this quiet, even in the country.

No one was around: the place was

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still deserted. Fifty yards would put me on a sloping embankment, up to a thicket of trees and the bridge.

Minutes later I reached the path. The road to Philadelphia was rutted and caked with mud. My clothes were still wet, but I had managed to wring most of the water out. It was a perfect day, and hard at first to get motivated into hurrying—blue sky, a breeze, and clean fresh air; but the image of that expanding red giant made me hurry my step.

The hours flew by. I'd only seen three people and seven farms since finding the road—a far cry from the crowded highways leading to Philadelphia five hundred years from now. But the people I passed were friendly enough, and they confirmed that I was indeed heading in the right direction.

The farms grew closer together. Climbing a knoll, I stopped to gaze down onto eighteenth-century Philadelphia. The small size struck me first. The highways and starport were missing, as were the incessant crowds and brown smog, but the river docks and grittiness were still present. Hitching my belt, I struck out for the center of town.

Dust mixed with a rancid smell rolling in from the river. However the romantics chose to paint old Philadelphia, the truth of the matter was that progress had been for the better and not the worse. I tried not to gape, but the flavor of the city seemed more like that of an old style western town—none of the congenial East Coast living that the historians would have us believe. A quick glance at a news sheet taped in a window confirmed the date: June 20, 1752. StarComm was right on the money. They'd done their part getting me here; now I had to do mine in the three days I had left, or I'd be jerked back to my future that didn't have a future.

Sounds bubbled around me: children shrieked as they darted across muddy streets; doors slammed, people laughed; horses trotted down the center of the street, neighing; and gentlemen tipped their hats to ladies. Weaving my way through the crowd, it took over an hour until I saw a sign over a building: DIALECTIC HALL.

My shoulders relaxed. It was one thing to know I was here on time, it was quite another to find out where I'd meet Ben Franklin. I had several hours until the weekly meetings would convene, so I set out to find a base camp.

Stepping back onto a side street, I entered the first inn I found, a building sporting a tattered sign, THE BULL'S EYE. Set not a hundred yards from Franklin's meeting hall, it would serve as a quick retreat.

As I entered the building, I smelled faint wisps of perfume. The room was dark; light diffusing through the windows didn't adequately brighten the interior. I squinted as my eyes grew accustomed to the dimness. Elegant davenports, spindly wooden chairs came into view; tobacco smells mixed in with the perfume. The room was not much larger than a glorified hallway, but it was decorated with paintings to the hilt. At the end of the room a man stood behind a large wooden desk. I approached and bowed slightly.

"Good day, sir. I am in need of a room for the next few days. Is it possible your establishment can accommodate me?"

The innkeeper placed his hands on

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the desk. His eyes took in my attire. "Traveling through, are you?"

"Williamsburg. I have been commissioned to teach at the college."

"Academician, then?"

"Yes, sir."

The man lowered himself to his chair and seemed to think about what I had said. He nodded to me. "What about your luggage?"

"I am traveling light—scholars need little more than a parchment and a pen." I smiled. "My ride arrives in three days. If I would not be an inconvenience to you. . . ?"

That seemed to break the ice. The man shook his head. "Certainly not. In fact, gentlemen often use my inn to participate in Dr. Franklin's discussions. Held once a week, around the corner, you know."

"Yes, sir, I have heard." I fumbled with my money pouch and withdrew several coins. The innkeeper barely nodded as I pushed the coins across the table. He remained expressionless until several more coins made the trip, finally grunting his approval when he felt that I had put forth adequate remuneration.

My eyes had adjusted to the light and the interior was totally visible to me by now. A thin layer of smoke hung in the room. Furniture was placed against the walls, low couches with flowery patterns on the material. I made out several people lining the walls, quietly watching me. Nodding, I turned to the stairs. When I headed up the steps, a young woman appeared by my side and seemed anxious to help me find my room. Smiling, she pushed the door open for me and waited for me to enter, which I did, and graciously thanked her for her time.

She waited outside my door longer than I would have expected, and as she left, I had a distinct feeling that she might be freelancing on the side. I pushed the thought from my mind: business first, or I'd be yanked back to the future without accomplishing anything.

I opened the shutters of the second-story room and peered down the street. I could barely make out the meeting hall. The place was closed now, but within a few hours, darkness would envelop the city and the weekly philosophical discourses would begin.

I hurriedly opened my belt and withdrew some more money and the letter of introduction. Things would have to start moving. I had a little over two and a half days to meet Ben Franklin and introduce him to twentieth-century technology, so he could start the laser revolution.

"Toad-in-a-Hole" is what the innkeeper called it. The recipe was conceived in England, but this was a local—and better—variation, or so I was told. The crust was hard, but the meat and dark sauce more than made up for it. With a full stomach and a glass of warm stout, I was ready to tackle the world.

I almost blew it by leaving a tip. I got a curious stare, so I mumbled that I had misunderstood the innkeeper and graciously took back some coins.

I struck out for the meeting hall at dusk. The road was dark and rutted, but I managed to navigate myself back to the main square. A crowd of men milled around the entrance. As the door swung open a boy with matted hair carefully lit oil lamps.

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An older man narrowed his eyes at me and nodded. "Good evening, sir."

I took a few short steps to him. "How do you do, sir?"

The man cleared his throat and looked me over. My clothes had sufficiently dried to appear presentable. StarComm designed my suit right on the mark, giving me the stature and appearance of an upper-middle-class gentleman.

Seemingly satisfied that I wasn't riff-raff, the man spit to the side, just making one of the cuspidors. "I don't believe we have been introduced, Mr. . . ."

"Grayson, sir. James Grayson."

He shook my hand. "Hall, David Hall."

I fumbled in my vest for the letter of introduction. "I just arrived in town. I have a letter from Monsieur Jean-Antoine Nollet at the French Academy of Sciences."

Hall smoothed the paper and squinted at the writing. His eyebrows rose minutely. "Doctor of Philosophy, eh?"

"That's correct, sir."

"Never could stand to have you people put on par with the medicinal field. Seems a crime, handing out all these degrees. Everyone should be a doctor nowadays."

Turning his attention back to the paper, he said, "So you studied under Nollet and are heading to Williamsburg. William and Mary is quite the talk these days." He cocked an eye at me over the letter. "Monsieur Nollet thinks highly of you."

I breathed a silent prayer for StarComm coming through again. *Thank God for computer forgery!* Taking the paper I folded it back into my vest. "Thank you, sir."

"Are you staying in Philadelphia long, Professor Grayson?"

"No, sir. Just long enough to rest up from the voyage."

Hall steered me into the meeting hall. "We'd be honored to have you attend our little conference then. I'm afraid this group won't be able to compete with the natural sciences in Williamsburg, but we do have our share of lively discussions."

"I'm sure you do. And I'll be honored to attend your meeting."

Hall smiled. "Actually, it's Dr. Franklin's group. As his partner, I'm only present to help organize the meeting."

The chamber quickly filled up with heavy blue smoke as men filtered in and lit up tobacco. Oil lamps threw flickering light throughout the meeting hall. I made small talk with Mr. Hall while scanning the crowd for Franklin.

A stir occurred at the front. A balding man stood and rapped for attention. Spectacles sat on his nose, adorning a large, square face. *That's him!* I thought. He looked just like the drawings.

I missed the first few minutes of Franklin's lecture—I was dazed, in awe of the man. So many advancements came from this one mind, it boggled my mind to catalog them: physical and social sciences, philosophical treatises, management concepts . . . it was no wonder that the men treated Franklin with respect. Swallowing hard, I tried to force myself to catch what he was saying: ". . . the nature of electricity . . ."

A buzz filled the room when the talk

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was over. As I moved up out of my seat, my head entered the layer of smoke which had been drifting lower and lower in the room. I pushed my way towards Franklin, following at Hall's elbow.

We pushed to within a single layer of people surrounding Franklin. Hall cleared his throat.

"Franklin . . . I say, Benjamin."

Franklin adjusted his spectacles and turned our way. "Ah, Mr. Hall. What is it?"

Hall turned to me. "I'd like you to meet a most interesting young man. Dr. Grayson just arrived from France and is traveling to William and Mary to teach in the natural sciences college."

Franklin's brows lifted. "Oh? From France, you say?"

I bowed slightly. "That is correct, sir. I have a letter of introduction from Monsieur Nollet."

"Interesting."

A moment lapsed before I realized that Franklin wished to see the letter. I fumbled in my vest and withdrew the document.

Franklin skimmed the paper and smiled tightly. "I am familiar with your patron. However, Monsieur Nollet and I were not on the most, shall we say, *best* of terms."

"Actually, he spoke very highly of you, sir."

Franklin pursed his lips and looked me over. "I'm sure he did."

"Your work in electricity has gained much notoriety in European circles. Monsieur Nollet impressed upon me that I was to fill you in on the details of our latest collaborations."

"No doubt to rub salt in the wounds. How long are you staying in Philadelphia?"

Blinking at Franklin's comment, I apologized. "I'm afraid I must be leaving in the next two days, sir." *Being yanked back through time was more like it,* I thought.

"Well then." Franklin rubbed his hands together and scanned the crowd. He seemed to think it over for a moment before continuing. "I'm heading back to my laboratory, Dr. Grayson. Would you care to take a look at some of my experiments?"

"Thank you, sir. I would enjoy that."

Franklin led the way. The crowd opened up for him, allowing us to pass. He moved through the throng like Moses parting the Red Sea.

Once outside, my head started to clear with the absence of smoke. The street was dimly lit, oil lamps throwing circles of light onto the ground. As we strode down the street, I was surprised at Franklin's pace.

It was then it hit me: I was still picturing the man from the textbooks I'd read as a student—copious wrinkles and thin, white hair.

His glasses and hairstyle were the same, but an aura of youthfulness radiated outward. I'd forgotten he was forty-six now—I realized with a shock that I was eleven years younger than he.

A turn down a secondary street brought us to his home. Franklin fumbled with the door before motioning me in. He lit several lamps while speaking. "I would invite you into the sitting room for brandy, sir, but Mrs. Franklin retires early on lecture night. I pray you will

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not be inconvenienced if we remain in my laboratory."

"To the contrary."

Grunting, he waved me to take a seat. Equipment sat in a jumbled heap in the back of the room. Tables overflowed with a potpourri of hardware. Franklin pulled up a chair next to me.

"So electricity is your specialty, Dr. Grayson."

"That is correct, sir. Electricity and magnetism."

Franklin frowned as he blew out his lighting stick. "What does magnetism have to do with this? I know Monsieur Nollet is unconventional, but yet—"

"It is a new idea." I broke in. "It demonstrates some similarities between electricity and magnetism." *Great,* I thought. *And we're a hundred years before Maxwell—I've got to do this gently or I'll be thrown out on my ear.* "Do you have any paper?" After he pushed some parchment to me, I drew in a breath. "Have you ever wondered what would happen if you could attach yourself to a tiny bit of electricity and move along with it . . . ?"

Two hours later Franklin shook his head. Taking off his spectacles, he wiped at them, rubbing the glass on his vest. He cocked an eye at me. "So you claim that electricity and magnetism are one and the same."

"That is nearly correct, sir. When you are moving with the electrical charge, you don't see a magnetic field; but when the charge moves past you, you *do* see the field." *I've got to slow down,* I thought. *At this rate we'll start tackling special relativity. But I guess once he's got Maxwell's equations, it's only a matter of time.* I drew in a breath. *So does this mean "Franklin's equations" will upstage Maxwell and Einstein . . . ?* I tried not to think of the ramifications—all that mattered was giving him enough background in elementary field theory so that he'd be able to both build a laser and know why it worked.

Franklin sat back and adjusted his glasses. Staring at the paper, he studied the equations I had walked him through just minutes before. He whacked the parchment with the back of his hand. "It seems so fantastic. To make this much progress—and not to have heard about it. How did you and Monsieur Nollet manage such achievements, and so fast?"

"It was not that fantastic, sir. Look at Sir Isaac Newton. He developed the calculus all by himself, in virtual isolation from the rest of the world; and his theory of gravitation swept the world in the same manner. We have not even had a chance to dessiminate this yet—Monsieur Nollet wanted your opinion first."

"But this is a piece of art . . . a work of magnificent elegance." He swept his hands across the papers I'd accumulated. Candlelight illuminated the parchment and threw a soft glow over the room. Shadows bobbled around, throwing crazy patterns on the wall. "Professor Grayson, I won't pretend to comprehend all your mathematics. In fact, I am not quite sure if you are pulling my leg or actually trying to teach me something."

I leaned forward. "Mathematical expression is only theory until it can be shown to have a physical counterpart."

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"Meaning that unless you can apply the theory, it remains a mathematical nicety."

It was my turn to sit back in my chair. I nodded.

Franklin studied my face. "I presume you have something to show me now that can prove that this theory is indeed true."

I scooted to the front of my chair. "Your laboratory—you still perform experiments?"

"Only to satisfy my curiosity."

I stood and moved to the back of the room, fascinated at finally being allowed to inspect his equipment. Hand-spun glass sat next to blown tubing; thin film plates, crudely twisted wires and jars of electrolyte sat neatly on the table. The apparatus was so crude, yet . . . everything was brand new; my mind wanted it to be *old*, antique. I glanced up at Franklin. He wore an amused smile.

"Well?"

I sputtered. "It is . . . marvelous. How have you managed to come up with such diverse accoutrements?"

"Surely this does not compare with what Monsieur Nollet has to offer."

Running my fingers over the glass tubing, I almost missed his comment. "Eh? In fact, it surpasses what we had." I hastily explained, noting Franklin's raised eyebrow. "Monsieur Nollet is more concerned with the theoretical aspects of our problems. We just don't have the experimental equipment to test them out." I motioned to the tubing. "Do you mind?"

Franklin waved a hand. "Please, pick it up."

Lightweight and versatile, the glass tubing seemed not more than millimeters thick. It was as straight as the eye could see, quite remarkable for the eighteenth century. Next to the tubing lay several optical pieces. I drew in a breath.

"The lenses?"

Franklin drew himself up and thrust out his jaw. "They are made out of salt. I am working on various crystalline structures to find an optimum index-of-refraction for the lens. An extension of Willebrod Snell's work, you know."

"This is superior." I held the delicate salt disk by the edges and peered through it. It was almost fault-free.

"Do you like it?" Franklin beamed.

"Yes, *sir*." I carefully placed the lens down and turned to him. "Monsieur Nollet had a fascinating experiment he wanted to try—except he couldn't construct salt lenses as well as you have."

"Would not glass suffice?"

"The radiation he was trying to modify was infrared—"

"Infrared?" Franklin frowned at me.

I'm getting out of step, I thought. I racked my brains trying to remember exactly how far America had developed physics. It was easy, looking back at the past, to tag a date on a discovery: Newton's law of gravity was established in 1686; but having the world accept that law, and actually disseminate the information was something entirely different. The knowledge of infrared radiation could have occurred *years* ago, but information spread too slowly because it was still being carried on the back of donkeys.

I tried a different tack with Franklin.

Moving to his bookcase, I pulled a

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book from the top shelf. "Allow me to explain. It has to do with the nature of light—in fact, its corpuscular nature. You know that water absorbs energy from the Sun—radiation. Monsieur Nollet uses this analogy: water stores energy by increasing its internal energy structure, much as a book stores gravitational energy when elevated to a higher shelf." I placed the book back on the shelf.

"I am somewhat familiar with that concept of energy storage, potential energy."

"Good. Then suppose I were to knock the book off the shelf." Shoving the volume, it hit the floor with a *whack*. "Energy is released, transformed into first motion, then sound and heat."

"Yes, yes, kinetic energy; but that is hardly surprising. What does that have to do with Descartes's corpuscles?"

I moved close to him. "We propose that light acts in much the same manner as energy. That is, we claim that light can be stored in certain materials."

"That is also not surprising."

"You are correct, it is not. But we also claim that when we submit that material to another light source, the stored light is released."

Franklin set his mouth and thought for a moment. "Such as phosphorus material emits light."

"Not quite." I turned to the table and picked up a glass blown tube. "We propose that gas can store a certain type of light. The gas releases this stored light when the gas is properly stimulated. This light is invisible to our eyes and is absorbed by ordinary glass lenses; but this type of light can pass through your salt lenses—we call this infrared radiation. And if this radiation interacts with gas, that stimulates even *more* radiation to be released. All moving together in a straight line."

I clammed up. In the last thirty seconds I'd given him a two hundred year encapsulation of nonlinear optics— lasers—in eighteenth-century language. It wouldn't all come out in the translation, and he needed time to digest it.

He had the basic theory—he just needed the proof. But if I could pull off an experiment, then I'd accomplished what I'd been sent here for.

Franklin took his glasses off and rubbed his forehead. He straightened and walked wordlessly back and forth. Pulling a stool next to the table, he sat. A flame flickered in the room, highlighting the stuffiness of the closed building. Wiping his lenses, Franklin used both his hands to return his glasses to his face.

"This is quite a treat for me, Professor Grayson. As honored as I am by Monsier Nollet's flattery, you have looked me up for more than a theoretical discourse. What is it that you are proposing?"

I swept a hand across his laboratory. "You have all the necessary equipment to perform our experiment, Dr. Franklin. Given a few hours, and a vial of relatively pure carbon dioxide, I can assemble this energy device. You will be the first person to conduct such an experiment."

"And Monsieur Nollet has not demonstrated this himself?"

"I have told you that Monsieur Nollet is theoretically bent, and only dabbles in experimental apparatus. Your labo-

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ratory is world famous, and it has the unique capability for us to prove our theory."

Franklin nodded to himself. "I see." Placing his hands on his knees he swept his eyes over his laboratory. He said wistfully, "I have another experiment planned, one to deduce the precise nature of electricity; but that will require a storm. Why don't we convene tomorrow morning and see what we can do?"

A grin ran wide across my face. "Yes, sir. Thank you, Dr. Franklin."

Twenty-four hours. I'll be yanked back five hundred years by this time tomorrow night. Now, everything depended on me getting the carbon dioxide laser to work.

I ran over the design in my head, one of twenty devices we cooked up for this demo. Since we didn't know exactly what apparatus Franklin would have in his laboratory on a day-to-day basis, the contingency plan took nearly all possible lasers into consideration that could have been built by Franklin: excimer, ruby, EDLs, GDLs, He-Ne, photodissociation, chemical, and even a dye laser. I was extremely lucky that Franklin happened to have everything for a CO_2 laser available. The gas, lenses, and tubing were all there. The discharge to invert the lasing population would be touchy, but Franklin had conducting foil and crude batteries—enough to build a simple capacitor for a single shot.

The laser alignment wasn't too critical, but getting a target for the IR to burn through had to be impressive.

I rolled over and pulled out the belt from beneath my bed. Next door, a woman shrilled loudly, her voice drilling through the thin walls; it sounded like she was hurt. I assumed it was the chambermaid. The noninterference policy dictated I should leave her alone, allow the local events to continue as much as possible. Maybe I shouldn't have tried to shoo her out of the room so fast earlier today. . . .

Another time, another era, but things haven't really changed *that* much. Most of the sounds stayed in the background—doors slammed, laughter, coy remarks that diffused through the inn's walls; but for the past fifteen minutes, loud sounds punctuated a continuing argument that erupted next door. I lost my concern when the shrills melted to a rhythmic bumping against the wall.

Fumbling with my belt, I spilled the contents on the bed. I pawed through dozens of bank notes, coins, and letters of introduction. Of all the items I'd brought, the only things not found in the eighteenth century were the recorders and magnet.

I picked up an English twenty-pound note. This should impress Franklin. It was just the thing to burn a hole through. I stuffed the contents back into the belt. Next door the bumping grew louder and increased in frequency. A man raised his voice.

I jerked my head at a scream; it suddenly cut off. A woman started sobbing. It sounded like she was being hit.

Interference policy or not, I couldn't sit idly by.

My breathing quickened as I swung my feet from the bed. Opening the door, I glanced down the hall. It was deserted.

Another scream. Feeling an adrenaline rush, I pounded on the door next

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to mine. A moment passed, then the door flung open. A man pushed an elbow in my face. I popped him in the eye as I was shoved against the wall. I turned to grab the guy.

My jaw dropped. Glaring, Ben Franklin scowled and twisted away, stomping down the hall. Inside the room a young woman wept.

As I slid to the floor, rain started pounding on the roof.

A fine mist hung over the streets. Horses clip-clopped across the puddles from last night's downpour, their hoofs echoing in early morning fog. Few people moved about, but I felt as if everyone was watching me.

I stood in front of Franklin's laboratory. Propping myself against the door, I watched the morning ritual as people woke with the day. Carts of vegetables, livestock, and grain were wheeled into the market. Men huffed under the weight of their wares, but yet had time to call out a greeting to their acquaintances.

As I waited, I ran over last night's events. StarComm's History Office had briefed me on Franklin's quirks as well as they could, considering the five-hundred-year time differential. They had mentioned in passing his affection for the opposite sex.

But what I had heard last night coming from next door wasn't any lover's quarrel. The girl sounded like she was in trouble. She *was* in trouble. And Benjamin Franklin or not, I couldn't afford to just sit around and keep still.

I flexed my arm and winced at the soreness. Franklin was agile as hell. He had stormed out of that room like a youngster. I was lucky we didn't come to serious fisticuffs; but at least I'd stopped him.

Afterwards, no one paid the girl any attention. In fact, from the stares I got, everyone seemed to imply that it was either her fault or mine that the outburst had occurred. The unvoiced pressure I felt told me I should have minded my own business. And how Franklin would react today would illuminate that feeling.

My best hope was that if he were anything like the psychoanalysts predicted, he'd ignore the exchange and chalk it up to professional courtesy.

Time passed. Trying to push last night's incident from my mind, I mentally went over the experiment: run wires into the glass tube; seal the tube with the salt lenses; inject the CO_2; then charge up the capacitor, and *wham*, ignite the twenty pound note with IR radiation. If that didn't convince Franklin to study lasers, then nothing would.

A horse clip-clopped down the street, whinnying as the rider pulled up to the building. Mr. Hall peered down at me.

"Good day, Mr. Hall." As I touched my hat, a pain stabbed up my elbow. "I am waiting for Dr. Franklin. I was going to show him an experiment Monsieur Nollet and I have developed."

Hall swung down from his mount and looped a leather coil around the hitching post. He stomped mud from his boots. "No use waiting outside, sir. Please come in while I open up the laboratory. Dr. Franklin should appear shortly."

"Thank you." I tipped my hat again.

Hall worked at the door; there was still no sign of Franklin. Sunlight flooded Franklin's work area. The open door

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soon allowed a breeze to enter and sweep clear the musty air, left over from last night. I walked around to the experimental area, trying to keep my excitement down as I spotted all the necessary equipment.

It would be a piece of cake. In fact, I'll be able to get off several shots, and leave plenty of room for Franklin to discover the other implications of laser light.

Stopping by the tubing, I absently caressed the fine workmanship that had gone into glass blowing the containment vessels. A voice thundered behind me—

"Keep your slovenly hands off my equipment!"

I whirled. Franklin stood shaking, a blotchy bruise covered one side of his face. Eyes red and narrow, Franklin breathed hard. He pointed a finger at me.

"You, sir, are not welcome in this laboratory."

"But Dr. Franklin—"

"Out, ruffian! Attack a gentleman at night. The tricks you have brought back from Paris will devour our youth. Get out!"

I sputtered and took a backwards step. "You've got to listen, the experiment is so simple. I don't have much time—"

"Out, damn you!" Franklin swept an arm across the lab table. Tubes and wires went flying, crashing to the floor in a crescendo of broken glass. Franklin's round body moved amazingly fast. He stomped across the aisle, shaking a fist.

I stumbled backwards into Hall as the man ran into the room. "What—?" He caught me and pushed me to the side.

Franklin continued his tirade. "Out . . . *out!* and if you come near this place, you will have pistols to negotiate."

More glass shattered as I sprinted from the room. Sounds crashed around me. Once outside, I leaned against the hitching post. Hall's horse nuzzled my ear. I pushed the slobbery mouth away. I could still hear Franklin inside, shouting, ranting at Hall. No doubt he would have to bear Franklin's wrath for hours to come. And that was bad; my pocket watch showed it was close to seven in the morning.

In ten hours I'd be yanked back. And the future would die.

The room at the Bull's Eye was dank, even with the window wide open. The midday Sun was hidden by dark boiling clouds, and with no air circulating, the room was nearly stifling. The chamber maids brushed past in the hallway, speaking in low voices. Scattered giggling broke the serenity, bringing last night's memories back to me in a flood.

How the hell was I supposed to know that Franklin would pick last night to go catting around? Sourly, I ran my fingers over the contents of the belt: besides the money, the recorder and superconducting magnet were the only things I had left. I had more than enough money to go out and get ripped, but what would that buy my world—*this* world? In six hours I'd be yanked five hundred years across time—back to a hopeless future.

Toying with the homing magnet, I studied the periodicity setting. Set to emanate a particular magnetic field geometry, the carrier signal from the probe

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would lock onto my exact location through the magnet's super concentrated field lines. The unique signature of the magnet's teragauss fields would provide an unmistakable beacon for the rescue. If the timing was right, I'd be yanked back to the future before the super high fields had a chance to affect me—and it would have to happen on the order of microseconds to beat the magnetic field diffusing past my "skin" depth.

Too bad this type of magnetic field hadn't been available to Franklin. Even two hundred years from now, quantum optikers would have given their left elbow to use these fields.

A peal of thunder broke my thoughts. Wind raced through the leaky building, sending a draft through the room. It smelled of rain. . . .

What a way to go, I brooded to myself. *It was a dark and stormy night—*

I sat up in the bed.

It was something that Franklin had said—something he bragged about during the meeting last night. . . . an experiment in a storm.

Storm.

Stormy!

Franklin had boasted of proving that lightning was electricity. *The next time it stormed,* he had said. From the sound of things, this afternoon's storm was going to be a gully washer. I couldn't remember the exact date Franklin had done his lightning experiments, but ten to one today was the day!

The thunder boomers picked up in frequency. A plan began to form in my mind. If I could find Franklin, I wouldn't need to build a CO_2 laser, and thus try to make him believe in something he couldn't see. Not when I had a tunable, *visible* laser right in front of me.

I grabbed the homing magnet and shot out the door. The paper money whirled around me as I left.

The trees shielded me somewhat from the rain, but the ground was still slick with water. Branches obscured my vision. The hillside was lit by sporadic lightning flashes. Thunder crashed around the hill, cascading toward Franklin and immersing him in a tumultuous frenzy of sound. A barn was behind him, but Franklin was out in the rain, unmindful of the deluge.

He stood like a madman, tugging at the twine that bore his kite. Water streaming from his head ran the length of his drenched body. High up in the air, barely visibly through the rain, the kite wavered, dipping around. It barely stayed aloft.

Franklin was alone; that startled me. I remembered that history chronicled one of his sons being present; and he was supposed to be inside the barn flying the kite. Maybe I'd changed things already.

I moved towards Franklin. I glanced at my pocket watch, brushing back rain on the crystal face. *Thirty-five minutes!* I had to hurry, or even this might not work. The foliage gave way as I approached. Franklin cursed at the kite above him.

Lightning flashed all around—it was a miracle Franklin wasn't hit, standing all alone out in the open like that. I got to within fifty feet when he spotted me. He had the end of his line wrapped around a sawhorse. Glaring, he turned and wrapped the string around him. He

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whirled back around after nearly loosing the kite, and moved from side to side, ignoring me.

"Dr. Franklin."

"Be off with you!"

I stepped closer, raising my voice over the rain and thunder. "Sir—"

"If you've come to apologize, then do so and leave. This is a critical time for my experiment." He tugged at the twine and muttered to himself.

A crack of lightning made me jump. *That was close.* I thought. And here we are standing like targets in a terrorist's circus. There wasn't time to screw around—if I wasn't yanked back home, the lightning would get me first. I stepped next to him.

"Dr. Franklin, I've got to show you my device."

"Get away, I said." He shooed me off with a hand.

"But, sir—look." I held up the superconducting magnet and pulled it taut. Twisting the magnet's tail, it pulsed slightly in my hand. "This is a magnet—just like the one you have in your laboratory, but it is a million times more powerful."

Franklin snorted. Adjusting his glasses, he wiped them on his wet vest while keeping a hand on the kite twine. As he placed his spectacles back on, they were immediately overrun with water—but I saw that he stole a sideways glance at the magnet. A moment passed.

"Impossible. You could not survive a force a million times stronger than I have in my laboratory—"

"The magnet is not on." *Great,* I thought. *Am I going to have to cover superconductivity as well as quantum optics—and in the next ten minutes?*

"Take my word for it," I persisted. "When the magnet is on, it will be that strong. But that's not the point." I nodded to the twine he stood next to. "Remember that laser I told you about, the one we could make in your laboratory?"

"I *said*—"

A crack of lightning made us both leap. I used the opportunity to jump back in.

"There is another way to produce light. Your electrons—the ones you're trying to prove exist in lightning—emit radiation when they accelerate. We call it *bremsstrahlung*. Magnetic fields make electrons change directions; a *powerful* magnetic field can make even the electrons in lightning change direction. And when they change direction, they radiate."

Franklin twisted his face as if he were trying to visualize my breathless tutorial. Water poured from his face.

"*Bremsstrahlung* . . . braking radiation," he whispered. "Yes, that makes sense."

I shouted over the noise. "Now imagine many powerful magnets all aligned together, just at the correct spacing to make the electrons wiggle back and forth as they go past the magnets. If the spacings are precise, the magnets can make the lightning emit *bremsstrahlung*, all at the same energy and moving in the same direction. That is the laser I explained."

"And your magnet . . . ?" Franklin's voice trailed off in disbelief. He stared at the tiny device I held.

I flushed. After all, I had to agree with him—it didn't look impressive enough to turn a low energy electron

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around, much less a lightning bolt. A low rolling sound filled the air. I screamed over the thunder.

"That's right. Let me run your twine through the magnet—I can set the magnetic's periodicity, and this will give us in effect a one-pass laser, a 'Free Electron Laser.' " I placed the magnet on his sawhorse.

Franklin stared at the device for some time. The rain slowed, but water still ran in tiny rivulets inside of my clothes.

Reaching out, Franklin lightly touched the electromagnet. He ran his fingers over the superconducting coating and whispered, "Who are you?"

The rain plopped around me as I stood mute.

Franklin straightened. "You, sir, are different—not from here. Not from Europe." He looked me sharply in the eye. "China? I have heard stories of strange experiments coming from the Far East. . . ."

I took a deep breath. "I'm from Philadelphia, Dr. Franklin."

"You *can't*—"

"Philadelphia five hundred years in your future. I've come back to show you how to make a laser from your own material."

Franklin took a step backwards. His eyes widened. "The *future?* Things I can make in my own laboratory . . . ?"

"Dr. Franklin, you're our only hope. You've got to study this phenomenon and radically change the advancement of physics. An engineering revolution is already on its way now: steam engines, cotton gins, manufacturing. But it's not enough. My world is about to be destroyed and you've got to ensure we have the right technology to overcome our threat."

He snorted. "Threat? I don't understand. How can I help someone five hundred years in the future?"

A crack of lightning sent us sprawling.

Ozone permeated the air. My vision was covered with purple and red splotches from the brilliance. I barely made out Franklin lying on the ground next to me. I rolled over and tried to talk—

—I couldn't hear.

Franklin rolled groggily around and pushed himself to an elbow. At least he was all right—history wouldn't be changed by his early death.

My ears rang, and I couldn't hear a thing he said. I dug into my pocket and fumbled with my watch. I squinted out of the corner of my eye to get past the blotches—*six minutes!*

Then it hit me that the kite was gone.

I scrambled to my feet. My vision was clearing, and my head yammered with a headache. I had to get that kite back up in the air. But where the hell was it?

I felt a tug at my pants. Franklin was moving his mouth, pointing to a clump of trees behind me. Scanning the misty horizon, I caught a glimpse of something white. I moved out like a shot.

I ran into the twine as I reached the bottom of the hill. Wrapped around a branch, the kite lay as if planted by a giant hand. The twine gave as I pulled, and with a sudden yank, it came free. The first thing I saw as it hit the ground was a brass key, tied firmly to the wooden structure.

Gathering the kite, I slipped back up the hillside. The rain abated, and I was

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almost scared to glance at my watch. Trailing the kite behind me, I tried to get it airborne.

Which was really dumb—starting a kite flying was one thing, but in the middle of a storm, running *up* a hill?

It didn't matter. Timing was everything now. First get the kite back up in the air. Then, if I didn't have the magnet primed and ready to go, I'd never get the free electron laser to work.

And if the magnet wasn't on, StarComm would lose my homing signal, and no telling where—or when—I'd end up.

I was out of breath and almost to Franklin when the kite took a bite of air. Soaring up, it dipped, then pulled up with a sudden force as it grabbed on to the gale.

I shoved the twine into Franklin's hands and dove for the magnet. Fumbling, I switched it on standby. Guesstimating the lightning's relativistic factor, I squared gamma in my head, divided by the wavelength of blue light, and punched in the resulting periodicity.

Franklin was on his knees, flying the kite. The sawhorse he had used to anchor it with was flung to the side. Rushing up behind him, I flung the sawhorse upright, pushed it into the muddy ground and set the magnet on top. Franklin handed me the twine; I ran the twine lengthwise down the magnet and tied it to the end of the sawhorse.

With the fields I punched in, the lightning shouldn't melt the magnet; I had programmed the magnet to switch on during the first surge. I made a grab at Franklin.

"Get out of here!" My voice sounded like it came through a layer of cotton.

Nodding, Franklin started limping away.

"No, this way!" I lunged out and grabbed at him, nearly causing us to tumble.

Franklin pointed at the magnet and shouted. "Shouldn't we get out of the way? We are right in front of it."

Dragging him by the elbow, I pointed back up the hill at the sawhorse. "We need to be perpendicular to the beam."

Franklin shook his head. "I don't understand." His wet hair hung limply to his head, and his clothes reeked with unwashed odors.

"You don't have to—quantum mechanics hasn't been invented yet." *Boy did that sound stupid!*

Reaching a grove of trees, we slumped against one of the smaller trees. The rain still pelted down, but the lightning seemed to have abated. Pulling out my pocket watch, I wiped rain from its face.

Two minutes . . .

Franklin reached up and patted my arm. "Dr. Grayson." He stopped, smiled gently, then continued, "Or whoever you are. Don't despair. I'm sure your other experiment will work—the carbon dioxide one."

I could only shake my head. After all, he didn't know the full story. He didn't have a clue as to why I was quiet.

What would happen if Franklin didn't make the advances we projected? What would happen if his research just died, withered on a vine? Or even worse, what would happen if he was branded as a kook—a *pseudoscience outcast*—that has always peppered civilization, with their perpetual motion machines and speed-of-light travel. *What if my trip back didn't work?*

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I don't know what made me look up, but I managed to yell, "Dr. Franklin—*the laser!*" A brilliant white flash, followed by a searing blue line, was the last thing I saw.

"Are you awake?"

"Uh?" I pried open my eyes. A nurse . . . pretty, and *not* dressed in eighteenth-century clothing, smiled at me. But it was a man's voice I had heard.

"Dr. Potiphor—!"

Potiphor stepped into view. He beamed. "Dr. Grayson. James. You are cognizant." He sat and took my hands in his. "I'm glad you're back."

"Yeah." I searched his eyes. "Well?"

"The neutrino flux has dropped five orders of magnitude since you've returned."

"I did it?! I've stopped the helium flash?" As I tried to sit up the nurse pushed me back to the bed.

"Well . . . we're not sure."

"But you just said I stopped the Sun from going nova—"

"*You* said that. All I said was that the neutrino flux has decreased." Potiphor pressed his lips together. "James, remember how fired up you were before you Jumped back to save the world? We needed your enthusiasm, your all-out effort." He hesitated. "We couldn't let you know that you can't change our past."

"Uh?" I had to start watching myself. That was my second brilliant statement in under a minute. "That's what *I* thought; but it worked. I mean I was in the past, the laser worked and you said the neutrino flux has dropped . . . *something* had to have changed!"

"You heard me. You can't change *our* past. If you could, then you wouldn't return to the same present. That and entropy violation." Potiphor had a faraway look in his eyes. "Yet, the Sun *has* slowed its rate of neutrino flux. . . ."

I struggled to an elbow. "Then why did you send me back? And what caused the neutrino flux to drop?" Talk about having your whole world collapse on you. . . .

Potiphor smiled. "Ahhh, good question. Because what you *did* do was to define someone else's future, a parallel universe's future, if you will. We realized from the beginning that causality cannot be violated—we could *never* change what came before us. But since you could go back and make changes, then it had to be another universe's future that you were defining."

I snorted. Potiphor held up a finger.

"Define, James, not change. And if "defined" correctly, then that parallel universe would develop the technology not only to find out about our plight, but to save us."

"So you were banking on someone else coming to the rescue. The cavalry."

"And it appears they did. But only after you planted the seed."

I was quiet for a moment. The whole thing seemed crazy. "So that time I spent in the past served to accelerate another universe's future; and now they've saved us."

"Apparently so."

I fell back to my pillow. OK, maybe I could swallow that. But something still bothered me. "How did you manage to pull me back through time? I didn't set the magnet."

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"We were trolling, right when you should have signaled us. We spotted a huge increase in magnetic flux and brought you back."

I was silent for a moment. "Good thing I was closest to the magnet, otherwise you might have brought back Franklin rather than me."

Potiphor's eyes widened.

I turned away, not liking the look on his face. A minute passed; Potiphor remained in the room.

And then it hit me.

I rolled over and said slowly, "If I changed a parallel universe, then why haven't they tried to make contact with us, tried to communicate?"

Potiphor shrugged. "Maybe because what you did wasn't enough. Maybe they advanced just enough to manipulate neutrino production in a parallel universe—*our* universe. Who knows? Maybe all they needed was another small nudge in order to actually travel here. Remember, you were the first to go back in time, James. We're still trying to unscramble the implications. Just think of the advances we could make if we could communicate with parallel universes. Just by going back in time."

My head ached at those implications. "You want me to go somewhere else in the past? But I've already changed *their* future—"

Potiphor pressed his lips together. "I was wondering when you'd get around to that. Of course you can't change their future—you've already defined it. But nothing is stopping you from changing still *another* universe's future; maybe enough so they can be the ones to show us all how to travel between universes." He paused as it all sank in. Then he got that far away look in his eyes again. "By the way, ever been to Arizona? Seen the meteor crater?"

"Uh?" I shook my head, no.

"You really should. It's quite impressive." Potiphor thought for a moment; he drummed his fingers on the bedpost and stared at the wall. "I know your specialty is lasers, but you *are* the only experienced time traveler we have." He looked up. "Have you ever wondered why they didn't discover the atomic bomb during the Civil War?" ■

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CLUB ARMAGEDDON

F. Alexander Brejcha

Are you *sure* it didn't happen this way?

Bob Walters

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Patterns.

People. Lives, past and present.

Patterns. As simple as connect the dots, or as complex as unraveling the teasing threads of unknown lives that lay hidden, scattered among a myriad of databases.

Why?

"Mike? Where are you?" Lyra's voice floated up from below.

"Up here, hon," he answered, pushing his chair away from the keyboard. On the monitor in front of him, a complex multi-tiered diagram rippled in a smooth and colorful pattern of undulating change. Names, addresses and dates.

Patterns.

"So this is where you've been hiding yourself," Lyra joked as she came up the steps to the attic he had converted to a study. Looking mildly annoyed, she swept back a wave of her titian hair as she bent down to study his face to see if he looked sorry.

He did his best to oblige.

Satisfied, she leaned close to give him a brief but searing kiss. It was a good thing her temper didn't match the flaming richness of her hair. Otherwise she would have had every right to feel neglected. He had been busying himself with his computer for hours on end, every night for over a week, now.

But fortunately, Lyra was very patient.

"What's all this?" she asked, waving at the shifting display.

"Listevaps Realty."

"Work? Another agency?" She stared at him. "I thought you hated the business. You're always saying that if it weren't for the commissions, you would have gotten out of real estate years ago."

"Well," he teased. "This isn't exactly work."

Lyra leaned over his shoulder, her warm body pressing delightfully near and distracting him. A trace of her perfume drifted down and he twisted to let his arm creep around her waist. Breathing deep, he pulled her close.

He felt her chuckle. "Well, I'm glad to see I haven't totally lost my husband to the computer. But now that you've piqued my curiosity, I'm going to make you pay for neglecting me the last few days. What's all this? And what's Listevaps Realty?"

Mike growled and nibbled on her side lightly. "OK. I'm sorry." He sighed and let go reluctantly. "Listevaps is a rather peculiar agency I've come across," he answered. "I downloaded a new program to test my memory expansion board. It's a pattern-maker and locator. I figured you might be able to use it for your artwork. The way the gallery keeps pressing you for more paintings, I thought it might give you some ideas. Some of the random pattern generations are fascinating."

Lyra looked at the slowly shifting display and cocked an eyebrow. "Oh, yes. Artistically fascinating."

"Well, that's not it, of course—"

"Of course." She smiled in a familiar way, obviously teasing him.

"But," he went on quickly, "the program can also uncover patterns where you wouldn't think there are any and I thought it might be interesting to interface it with various data-bases. I downloaded a whole series of realty data-

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bases and ran the program on each, hoping to catch any patterns or trends that are consistent across the country, and that are unusual. Don't ask me why. There are thousands of possible patterns, of course, but I laid down a lot of exclusion parameters. I also specified that I was only interested in illogical patterns. I wanted to see how good the program was. And that," he pointed at the screen in front of them, "is one of the illogical patterns the program came up with." He speeded the display up slightly.

Taking pity on him, Lyra studied the screen intently, her green eyes squinting. After about fifteen minutes, her eyes opened wide and she looked back down at him. "If I read the time scale right, it means that all these properties are changing owners exactly one year apart—"

"In staggered one-week intervals running in a wave from west to east," Mike finished with an admiring grin. "You catch on quick, hon!" He squeezed her tight, relishing the feel of her body close to him. "For the past five years, each of these properties has been managed by a single realtor—Listevaps—and leased, sold, or rented for exactly one year. To the day! That kind of turnover and pattern is totally ridiculous." Lyra stroked his hand absently and continued studying the display. Then he felt her stiffen and lean forward to peer closer.

"No kids?" she asked after a moment, sounding confused. "All these people, and not one couple has kids?"

Mike's grin vanished and he looked at the screen. After a minute, he let go of her and typed something quickly on the keyboard. The display changed into long columns of names and numbers that scrolled quickly by.

"You're right," he finally said, and leaned back with a puzzled look. Not one of the couples has kids. A lot of single occupants, but out of all the couples, not one has, or had, a kid."

"That's impossible!" Lyra was staring at him.

"Statistically improbable at least, I'd say. But so's this whole pattern. It's carefully orchestrated so no area will be too busy at any one time. But it doesn't make sense. And what makes it worse is that there are four different patterns."

"What do you mean?" Lyra asked.

Mike kept staring at the screen, answering absently as more questions popped up in his mind. "I almost missed the patterns because there are four groups of property turnover. In each group, the moves are staggered one week apart, and moving geographically each week. For example, in San Francisco a house changes hands on Monday. Next Monday, a house in Denver, then a week later, a house in Chicago. And then the following, someone moves in New York. That's one chain. In the meantime: on Tuesday, someone moves in L.A., a week later, someone in Colorado Springs, and so on across the country. But each string is consistent in moving east, and with moves exactly a week apart."

"Why?" Lyra asked, echoing his own thoughts as she dropped onto the overstuffed sofa in the corner and crossed her legs in a yoga position.

Mike cringed. It hurt just to look at the limber ease with which she settled down. Then he shrugged. "I don't know, hon."

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"Call them and ask." Lyra smiled, displaying her usual, and occasionally irritating, habit of being supremely practical and straightforward. She had never been one for subterfuge.

He started to protest automatically, but then stopped. Why not? He could always dig deeper if they refused to tell him, or if they gave him a runaround.

He reached for the keyboard to find the number for Listevaps Realty. . . .

cold . . . frozen moments . . .

He stared at his keyboard. He felt disoriented. What was he doing?

Of course. The new pattern program.

Patterns. Colors, shapes and patterns.

He turned and smiled to Lyra, who sat stiffly on the couch, looking a little dazed. "See?" He typed a number of commands quickly. "You set up some parameters for the general category of patterns you want, and the program will generate a series of them according to the delimiters you set up." He pressed the return key and the screen filled with a shifting kaleidoscope of triangular forms that shimmered in a rainbow of colors.

Lyra unfolded her long legs and jumped up off the couch with a grin, already back to normal. She studied the dancing shapes on the screen. "That's beautiful! Thanks, lover." She came over to him and gave him a deliciously warm hug. Then she pointedly turned away from the display and her eyes lidded provocatively. "But it's late now. Are you coming to bed soon?" She bent down and nibbled gently on his right ear, her breath a warm summons that sent a shiver down his spine.

"Oh yes," he answered quickly, his arms reaching up to capture her. "Let me just turn this off, and I'll be down."

"Just don't turn everything off," she warned him with a sly grin and slipped out of his embrace to disappear down the steps.

He turned back to the keyboard. "Sorry, but I just had a better offer." He started to exit the program when he stopped, a tendril of memory teasing him.

Patterns. Not just visual patterns. Patterns of . . . names? He put his elbows down on the desk and cradled his suddenly aching head. As he did, he accidentally knocked the keyboard to the side and uncovered a slip of paper. Two words stared up at him. "Listevaps Realty."

"Listevaps?" Why did that scream at him so?

Idly he played with a pen and scribbled on the pad. Listevaps . . . Vastelips . . . Pestavils . . . Pastevils . . . Pastlives, Past lives! Lives? Why? Lives . . . Names . . . Patterns of names. Suddenly that seized his attention and his fingers strayed over the keyboard, uncertain of where to begin.

"Lover?" The sultry voice drifted up the steps, and a light creaking warned him that Lyra was coming back up.

He was torn between the obvious and tempting invitation clear in her voice, and the sudden urge to explore a mysterious pattern that seemed to have eluded him.

Then, on his desk he saw a list of numbers . . . real estate offices' names next to them. In the back of his mind he felt a stirring of recognition and a feeling that this was important. Vitally

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important. He was staring at the screen so intently that he was startled when he heard a soft sigh behind him.

"I'm losing you, lover. What does that machine have that I don't?" Lyra asked wistfully.

He turned and swallowed when he saw the vision confronting him.

Lyra was dressed in a sheer black nightgown that left absolutely nothing to the imagination as it floated around her body; dancing on currents of nylon-generated static. Alabaster skin, lightly dusted with freckles, screamed to be caressed and held as it dipped in and out invitingly on familiar half-obscured contours that extended to long dancer's legs that were lightly poised. The right leg was delicately bent to show off the muscled calf and slender bare foot.

"Nothing!" he managed to get out after a moment, voice tight with emotion. He reached out to turn off the computer, not bothering to exit the program properly. But his hand froze as he touched the power button.

Something in the back of his mind screamed for attention, no matter how hard he tried to push it away.

Suddenly Lyra's nightgown billowed with life and he felt his own hair stirring as a crackling sound came from the far corner of the attic, accompanied by a bluish light and a loud "Shit!" in a guttural, vaguely foreign-sounding voice. "They didn't scan thoroughly enough."

Lyra moved in behind Mike and slipped her arms around him to pull him close as she looked over his shoulder, fair skin reddening in a faint blush as they confronted the strange, silver-clad visitor who had appeared from nowhere.

He was about five foot six, had a creamy light brown complexion, and strangely non-specific features that spoke of a generous mix of races. He might have been very handsome, but his face was twisted in an angry scowl. He was shaking his head and muttering ". . . they missed that note and the list. If they'd gotten them, you'd be down with your wife right now doing what you'd much rather be doing anyway. Hell, so would I!" He eyed Lyra appreciatively.

Mike felt Lyra stiffen. He knew the sign and grinned as he whispered, "Relax, honey. Let's find out what's going on before you slug him." Then he looked back at the intruder, realizing he had to be in shock as it suddenly dawned on him to ask, "Who the hell are you?" And as it sunk in how the stranger had appeared out of midair, he stared and went on numbly, "and where the hell did you come from?"

"In a minute. I'm Controller Mayes. Thanks to the bungling of some nervous junior monitor, we're in danger of a time-stream deviation—"

"A what?" Mike asked.

"A time-stream deviation. You were using your new program to play with pattern searches and found out something that set up alarms for the monitors—"

"Wait a minute!" Mike interrupted. "What the hell are you talking about?" He was getting angrier by the moment. Mayes was talking like he thought Mike knew what was going on.

"Oh?" Mayes looked mildly surprised. "You haven't remembered it all yet? No matter, you were about to. That note and the phone list were reminding you. The mind-wipe doesn't set right

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away and you were starting in on the same thought patterns that led to your discovering us the first time. Unfortunately, we can't play with your memory again. It might do irreparable damage."

Mike sensed Lyra's confusion and squeezed her hand gently. He felt the same . . . except . . . now that the stranger was talking about it, flashes of a totally different pattern on the screen teased his mind.

"Names?" he heard Lyra whisper and looked back to see her face screwed tight in concentration, eyes shut and delicately arced brows drawn together. "Names of people, and houses," her eyes snapped open wide just as her words supplied the needed trigger for him.

"Real estate listings, changes in ownership, one year occupancies—"

"See? I told you. Amateurs!" Mayes sounded disgusted. "They should have scanned for any remaining triggers like those. Another five minutes on the scan and they would have seen you pick up the paper under the keyboard and they would have removed that phone list. Luckily there was a back-up station online a year down-time and they caught the drift before it spread too much."

It finally dawned on Mike what their visitor had to be referring to. He couldn't believe what he was casually considering. Either he was still feeling the effects of whatever they had used to erase his memories, or he was in shock. "Are you from the future?" he finally managed to get out.

"No kidding, numb-nuts," Mayes responded sarcastically. "Is that current? Whatever. I like it. Yes. Sit down. And tell your wife to put something on, for Time's sake. I've been celibate for almost six months because I can't afford to leave any stray genes around."

Mike went to the battered sofa in the far corner—Lyra following close—and grabbed the patchwork-quilt that covered it. Lyra wrapped herself up gratefully, a helpless grin on her face as she said quietly, "I *was* tired."

"And I was . . . never mind." He grinned back and saw her duck her face, trying not to laugh.

"Enough bonding, already," Mayes interrupted. But his voice was gentler, almost envious. "Sit down, please." He waved at the couch and dropped into the chair Mike had been using.

"This is going to be a little complicated, but bear with me," Mayes began. "I'm from the future. About a hundred years, to be precise. And it's a nice, settled world. Thanks to something called nanotechnology—"

"Nanotechnology?" Mike and Lyra asked simultaneously.

Mayes sighed. "Yeah, it's a new science that you're only now starting to research. Microscopic machines built up atom by atom, though your scientists haven't gotten that far yet. But these little machines can replicate themselves and break down and alter matter. And thanks to them, the world's been cleaned up and resources are plentiful. It's a wonderful world." But his voice was less than enthusiastic.

"So, why don't you sound happy about it?" Lyra asked.

"It's boring!" Mayes answered. "World tensions have been going on so long that strict political rules had to be formulated and enforced. It's brought peace, but everything is so formalized

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and protocol bound that there's no spontaneity or unpredictability, no fun or excitement. Excitement might lead to disagreements. For a lot of people, it's paradise—''

''But not for everyone, huh?'' Mike guessed. ''And you're—''

''Taking vacations in the grubby, tension-filled past!'' Lyra finished.

''There are always anachronists, it seems.'' Mike shook his head. ''Go back in time and get mugged in New York City, or visit the great landfill in New Jersey. Come see 'Hypodermics by the sea performed live by the Atlantic Ocean,' co-starring the Hudson river oil-slick. And be sure to visit the Chesapeake Bay wastes . . . .'' Mike stopped himself, realizing he was getting carried away.

''No,'' Mayes denied. ''The big draws are 'escaping from the East Block,' 'checking out a Contra raid in person,' 'race riots in South Africa,' and 'drug busts in big cities.' Those are just a few examples. And in a couple of years there will be a few other neat ones like the East German occupation of West Berlin in '91 and—''

''That's sight-seeing?'' Lyra sounded horrified as she cut him off.

Mayes shrugged. ''Tacky, maybe, but they're willing to pay major-league prices. So we set them up with cover-identities, era-currency, accommodations, and a solid set of rules to follow. And a few weeks after each placement, we've set up monitoring posts that are isolated and can detect and pinpoint any variations in the time-stream. Then a monitor is dispatched to correct the variation. Interference infractions are rare because anyone caught is automatically banned from further expeditions and fined, in a big way! There's also the explicit warning, exaggerated on purpose, that interference may mean wiping yourself out of existence. It's not wise to monkey with time.''

But Mike suddenly had the feeling Mayes was lying through his teeth about something. . . .

cold . . . frozen moments . . .

A brightly lit room. Cold, hard edges of metal and glass. Mike was sitting next to Lyra on a hard bench and Mayes was sitting on a low chair across from them, wearing a dazed look.

Mike groaned. Not again!

At one end of the room a man and a woman stood frowning. They were dressed nearly the same as Mayes. The woman stepped forward. She was a striking lady, Mike noted. Not as beautiful as Lyra; her features were too hard-edged. But there was an air of nobility about her; in the way she carried herself. She wore her blond hair close-cropped. Almost like a helmet. And she wore no make-up. But her eyes were incredibly compelling, wide blue pools that were almost too large for her face.

But at the moment they were full of scorn as they looked down at Mayes. She reminded Mike of someone looking at a pile of shit on the floor of a four-star restaurant. ''So that's what you look like in your time-stream,'' she said in a low, musical voice that managed to ooze contempt. ''Soft!''

Mike realized suddenly what she meant as he looked at the man behind her. The man was Mayes! But a lean, hard-edged version of the controller.

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Mayes—their Mayes—*was* soft-looking in comparison. A little overweight, and . . . soft. It was hard to define and not apparent until you looked at the new version of Mayes. The face was lined and weathered, and the body was tightly sculpted, with hard muscles rippling under the tight silver tunic. And the eyes were cold and hard, like chipped ice.

There was something else in the eyes, too—both the man's and the woman's —a look of resigned despair. Lyra must have noticed, too. She got up, holding the quilt around herself carefully.

"What's wrong?" she asked the woman gently.

"Wrong?" the woman laughed bitterly. "Why don't you ask him!" She nodded in Mayes's direction. Their Mayes, Soft-Mayes.

The controller had noticed his double, too, and looked extremely nervous. "Alternate time-stream?" he asked.

Tough-Mayes nodded. "What this time-stream will become because of your meddling, and their discovery of your interference." He glared at Mike and Lyra for a second. "Take a look!" He spoke a few undistinguishable words into a small button on his collar, and in response the large wall off to the right shimmered and they looked out on a devastated world. Murky air shifted with the wind over a ruined city. Twisted skeletal skyscrapers leaned and sagged, stripped of glass.

"World War III started in June '96. The trigger was in the Middle East, with East and West supporting different factions. That wound up triggering conflicts in Europe that had been brewing for a while, ever since West Berlin got occupied. Nukes wound up used on both sides on the second day, and it spread like wildfire. That," Tough-Mayes nodded at the twisted mockery of a city on the screen, "is New York City. Wall Street, as a matter of fact." A few more soft commands and the scene shifted with a rapid succession of shots ranging from more battered cities to turgid oceans littered with waste, and stunted, disease-ridden groups of people scrabbling to raid shattered stores for cans of food.

Mike was confused. "How can you both be here? That," he shuddered as he looked at the hideous scenery on the screen, "isn't the bright, if boring, future he comes from." He nodded in Soft-Mayes's direction.

"No," Tough-Mayes responded. "Because when you discovered his presence, they panicked in trying to rearrange things to prevent a repeat discovery. The first mistake was in screwing up your mind-wipe, and in my time-stream, things escalated from there. We came back and grabbed the three of you when we did, because this is the point of divergence—the point where his future was disrupted and mine formed. Frankly, both are perversions of what should have happened."

He turned to Soft-Mayes, face threatening. "When we let you go, it will be your job to go back to your time to tell them to stop interfering with the past."

"What do you mean interfering?" Lyra spoke up, her voice dangerously quiet. Mike knew the tone and smiled.

"You tell them, Teela," Tough-Mayes sighed and turned away.

"What he means," the woman explained, "is that Mayes and his crowd have been carefully perpetuating the

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tense world situation to give themselves more places to put their tourist trade."

Mike heard Lyra gasp, she came over to him and grabbed his arm tightly. The look she shot Soft-Mayes should have killed him on the spot, but he must have been tougher than he looked.

"For example," Teela went on, "East Germany was going to be persuaded to invade West Berlin. NATO will retaliate and World War III will be a breath away before East and West cool down. Mainly because both Russia and America are terrified of a war starting over something stupid. But because of it, Gorbachev will lose control of the Soviet Union and new hard-liners will take power to control the East Block more effectively. Exciting times for the tourists, perhaps, but dangerous for the world. Because your discovery of his presence scares them. Their bungling," she glared at Soft-Mayes, "makes a crisis in the Middle East escalate to war which brings the new, hard-line Russia to bang heads with the US—"

"Which leads to World War III," Mike finished numbly.

"And the irony," Tough-Mayes added, "is that the boredom my counterpart's people are fleeing from so they can come back here and visit, is their own fault."

Mike remembered something Soft-Mayes had said when he had first appeared and he looked at the controller with scorn. "The world tensions you're fostering to give your tourists more interesting times to visit—"

"They're the reason your world got so structured and formal," Lyra cut Mike off. She had guessed what he was thinking.

Tough-Mayes nodded. "Very good. If they would have continued interfering and keeping the world just this side of world war, they would indeed have formed the uptight, but safe and boring world he comes from, which serves them right. But your discovery means they panicked and started making mistakes, leading to my time-stream. But, like I said, neither of our time-streams is the natural one. What would have happened if no one had interfered anywhere?" he asked with a shrug. "We don't know, but we want to give you a chance to find out. We can't go back and stop all past interference, we don't have sufficiently detailed records for that, but here is a crucial time-point when a major divergence occurs and we can intercede here."

Teela stalked towards Soft-Mayes and backed him into a corner. Tough-Mayes was right beside her. "You *will* go back to your time and tell your people to back off. From this point in history there will be no further interference! You want to go back in history and visit, fine. But no more interference. We can monitor for that."

"We may be busy with developing nanotechnology ourselves now, so we can clean up our world," Tough-Mayes went on. "For us, the world situation stopped the research. But we'll manage to keep an eye on this era, and on you." There was no mistaking the bitter anger in his voice. And a trace of uncertain fear.

Mike wondered about that as Lyra spoke up. "Why don't you just go into your own future and get it?"

Mike smiled. She always was one to get directly to the point.

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Teela shrugged. "Forward travel is impossible. Possibly because it might lead to paradoxical situations."

"Well, going back and killing your own father before your conception might be called a paradox, too," Lyra pointed out.

"No," Teela countered. "Then you'll cease to exist in your time-stream and the original time-stream will go on undisturbed, and an alternate stream will be created where you were never born. Basically, you disappear from one time-stream the moment you kill him."

"Oh." Lyra shrugged. "Just curious."

That brought up a question and, remembering the flash of fear he'd seen before, Mike glanced over to Tough-Mayes. "What happens to your future if you prevent your time-stream from being formed?"

"We can only assume that we'll continue, since we're here in the first place, in our time-stream. Our scientists feel that there are an infinite number of time-streams, each formed by possible decisions in history. We can't travel laterally to an alternate branch at the same point in time, but we can go back to junction points like this where the branches of time are actually formed. Our hypothesis was that by doing this, we'll create a new time-stream. One where the tensions don't escalate into either my soft counterpart's boring world, or into our ruined one. Maybe we'll be able to allow you a more natural, peaceful world."

"But that's just a guess," Lyra said. She reached out and touched both Teela and Tough-Mayes tenderly on their shoulders. "Thank you." Two simple words, but with a wealth of emotion.

Mike joined her and extended his own hands. They were gratefully embraced by soft and calloused return grips. "So," he asked after a moment. "Now what?"

Tough-Mayes shrugged. "We'll put you back, ask you to keep quiet and leave you alone."

"But we know what's going on, what if we talk?" Lyra asked.

"Remember what happens if you do and my counterpart's people find out?" Teela cautioned.

"Oh." Mike grimaced and Lyra squeezed close. "World War III. That's a pretty good reason to shut up." He was quiet a moment and then went on to ask, "I wonder what will happen? I don't see a Mayes from our hypothetical new time-stream here to counsel us."

Teela and Tough-Mayes shrugged helplessly. "I don't know," Teela admitted. "They either didn't discover time travel, or there's too much else going on to worry about the past. Theoretically, with the development of nanotechnology in a peaceful world, the environment can be cleaned up, resource problems eliminated, and mankind might be freed to seek out the stars. A lot more fun than grubbing around in the past, I'd think."

A dreamy look came over Lyra's face and Mike smiled. She was a science fiction addict from way back and what she was hearing was music to her ears. His, too. She turned to him and grinned. "I think we can be persuaded to keep mum, eh hon?"

Mike just nodded and stared into her eyes. A long peaceful life with her, in

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a more peaceful world? Yes, he thought, he could handle that.

cold . . . frozen moments . . .

A headache! A splitting headache. "Oohh, I think I've been zapped too many times." Next to him on the old couch, he felt Lyra's warm body stir and moan sympathetically.

"You and me both, lover!"

Mike looked around the familiar attic office and sighed gratefully. "Well, Toto, we're home."

"Are you comparing me to a canine?" Lyra's voice was getting a little stronger, and obviously her sense of humor was coming back too, because she sat up and flashed her quilt open provocatively for a brief moment. "Does Toto have anything to compare to this?" she asked in a sultry voice.

"No way!" Mike was emphatic. "And neither does this." He went over to his computer, locked it off, and removed the key on the CPU, handing it over to her with a flourish. "I'll turn this over to your safekeeping."

She took it carefully and studied it, and his face, for a long moment. Then she smiled and handed it back. "That's OK, lover. I'm not that insecure."

His voice was husky as he tossed the key back without really looking where it went. "I'm calling in sick for the next week, and so are you. I feel like a little vacation myself."

Lyra didn't answer, but just opened the quilt in invitation.

A blissful week later, reality returned.

They had refused to answer the phone, watch TV or read a paper, but after a week, it was time to rejoin the world and catch up on the news. Lyra went to the door to get the papers while he checked the answering machine in the living room, smiling as he skimmed through half a dozen messages asking him to please call the office as soon as he was back in town.

Then he heard the sounds of paper rustling, punctuated by soft gasps behind him. Turning he saw Lyra standing there in disbelief, staring at the front page of one of the papers she had piled on the coffee table. She looked up with a dazed, but joyful expression. "They're all like this, lover. Look!" She held out one of the papers for him to see the bold headlines that proclaimed "The Berlin Wall comes tumbling down!" ■

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REHEARSALS FOR RETIREMENT

Jeff Hecht

A big, long-term goal can easily be obscured by more immediate concerns—especially when bureaucracies are involved.

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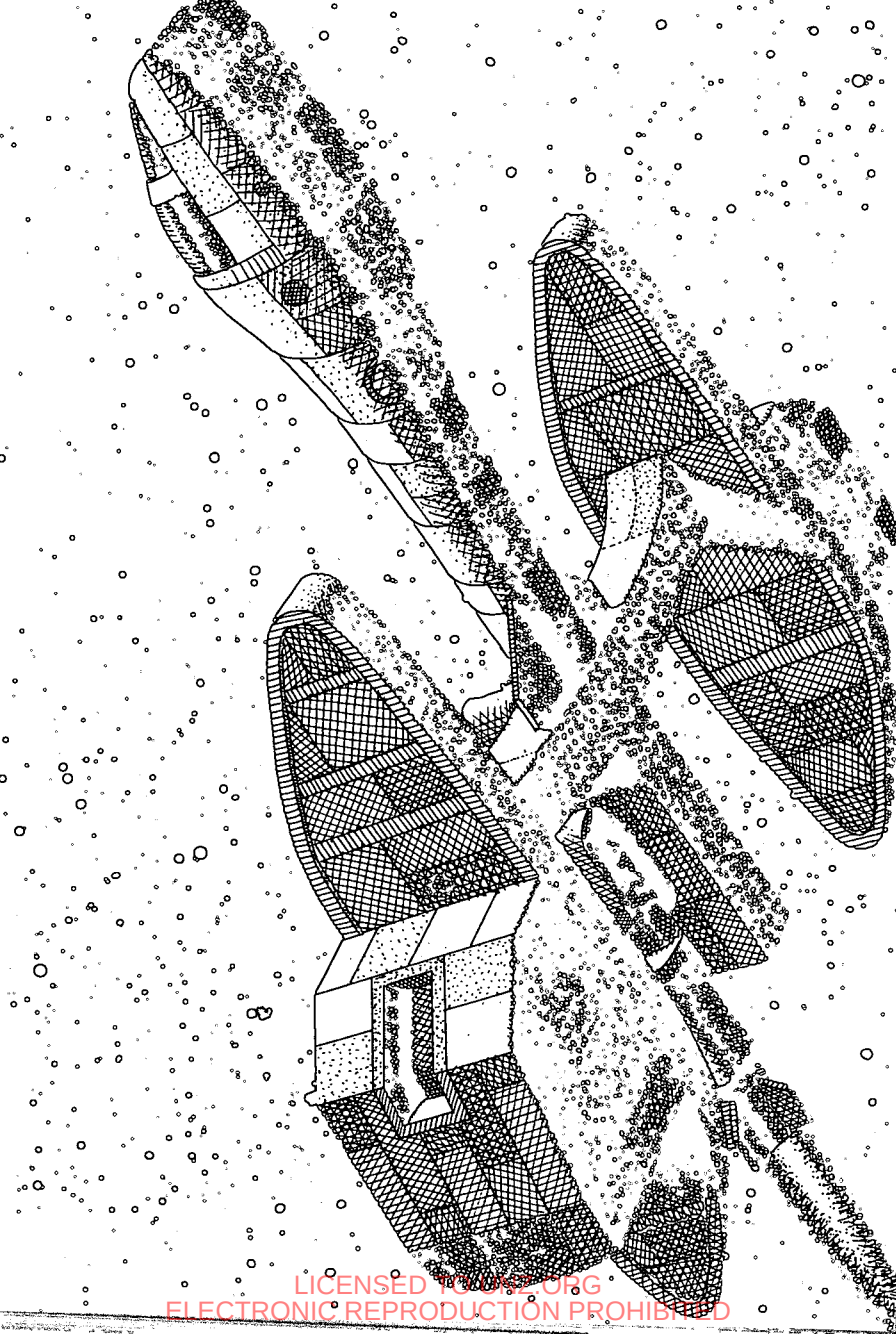

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The captain of the spaceship *Ronald McNair* ran through the calculations again, but the results were still not encouraging. After eleven years in the air force and twenty-five in the Astronaut Corps, Marty Allen felt entitled to a decent pension, but the bureaucracy had other ideas. His last time back on Earth, the offensively officious young woman who ran the benefits department had only frowned and reminded him, "You should be grateful you people in the Astronaut Corps can retire at fifty-seven with a pension. People here on the ground can get laid off with nothing."

He shut down the little portable computer, swearing under his breath at the politicians who had privatized the International Space Cooperative, and at the managerial bureaucrats who ran it from the ground. He looked away from the flatscreen display as it flipped between normal and reversed polarity, fading to its neutral gray off color. His machine was only five years old, but the *McNair*'s main cabin showed its age. It had been built over twenty years earlier, in the Cooperative's last boomlet of activity, after an asteroid missed the Earth by 40,000 miles in 2024. The Asteroid Hazards Commission's estimates of impact probabilities had stimulated vast infusions of cash from paranoid American, European, Japanese, and Russian groundlings. Marty had joined the Corps then, eager to escape the stagnation that disarmament had brought to the US Air Force. He had had no idea that would be the last major investment in manned space flight.

"Have you looked at this one yet, Marty?" asked his sole companion, mission scientist Fern Ky.

The question took Marty away from his rehearsals for retirement, and back to the job at hand, the obliteration of potential asteroid menace number eighteen out of twenty. Fern was four years older, but packed more energy into her ninety pounds and four feet eleven inches than Marty did in twice the mass. She was going to fight the retirement that awaited them when they returned to Earth; he had come to welcome the idea. Marty admitted he hadn't paid much attention to the two-kilometer rock that appeared as a digitized blob on his viewscreen.

"It has unusual spectral signatures." She copied a display from her screen onto his. It showed a series of spectral peaks as a function of wavelength. "These are the standard lines from the solar spectrum," she explained, as faint white labels appeared on the screen. "If we subtract the solar lines, by comparison with a direct readout from the Sun, we can isolate the asteroid's absorption." A spectrum appeared, with red labels giving absorption wavelengths. "It shows all the usual rock lines, but it also has some surprisingly strong metal lines." Bold yellow labels appeared and began flashing beside several peaks.

"So we got a nickel-iron this time." They had been blowing up rocky asteroids, along with a couple of dead comets.

"Not exactly, Marty." She took remote sensing far more seriously than anyone else left in the Space Cooperative. A decade ago the groundling man-

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agers had tried to drop remote sensing as not cost effective, until the engineers had pointed out that the asteroid ships already had the equipment and had to have two people on board. Now the managers were automating the whole fleet, to save money and get rid of the troublesome people who wanted to spend money on science and exploration. Supposedly data would be recorded automatically. If it was, Marty expected it would be consigned to the same bureaucratic oblivion that awaited Fern's data when they got back to Earth. "Compare it to your standard nickel-iron spectrum," she said. Another plot appeared on the screen, this one blue with blue labels. "A difference spectrum shows what's really there."

A green plot appeared midway between the blue line and the spectrum with the red labels. Fern played with her keyboard and controls, and three labels on the green plot turned bold yellow and flashed slowly on the screen. Marty stated at the words: "*Aluminum*," "*Copper*" and "*Titanium*." "Metallic?" he asked, doubtfully.

"Yes," she said, "elemental. Shiny enough that the sensors have recorded several glints. We've got something funny down there."

Marty didn't welcome the challenge of something new. After blowing three more asteroids to nonthreatening bits, he could retire from the Cooperative's demolition derby. He had spent too many years pretending to protect humanity from the type of asteroid impact that got the dinosaurs. He was tired of worrying about managers, corporate bureaucrats and half-crazed dreamers with Ph.D.s "I doubt it's anything much, Fern. It must have accreted from somewhere. . . ."

"That is unlikely. I need to run more readings, but the computers can't match it with anything in the memory banks. I've registered it as an anomaly."

He nodded grimly, knowing what that meant. The mission scientist had the option, or perhaps it was the duty, to notify headquarters if they discovered anything. The regulations were forty years old and nobody back on Earth gave a damn, but that wouldn't stop Fern. She would use this excuse to try to stretch the mission so she could explore the asteroid. He knew the managers back on the ground would chuckle at "Crazy Ky," and deny the request. They would put the incident on the long list of human problems that would end with the automation of the *McNair*, the last of the old manned ships. Never again would astronauts discover something managers didn't want to know.

Marty stared at his viewscreen as Fern copied enlarged images of the asteroid onto it. It was bright against the blackness of space, but it would have been black against his own dark skin. "Mean albedo 0.070," announced the display in the lower right corner; it would have said so out loud if Marty hadn't turned off speech synthesis to keep from going mad. Something flashed on the screen momentarily. Fern ran her fingers across her keyboard, and the flash returned to their screens in freeze-frame. "Mean albedo 0.083," read the display.

"There was another glint. It must have been a good-sized area, too," she said, studying the screen. "It increased net reflection by nearly 20 percent. I'm going to signal the base."

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Marty didn't bother telling Fern it wouldn't do any good. The radio message would take fifteen minutes to travel to distant Earth. If the bureaucrats deigned to reply, their message — inevitably a lengthy variation on the word "no"—would take another fifteen minutes to return. That would take the *Ronald McNair* half an hour closer to its target, and bring Marty half an hour closer to checking off asteroid number eighteen.

The reply took over an hour to arrive. Marty wondered if anyone in the control room was authorized to reply. Doubtless, the managers would prefer that no one could. The controllers would have to fill out forms in quadruplicate, to guard against responses outside of the organizational norm. It was necessary to follow the proper chain of command to assure proper coordination and a most cost-effective mission, as the policy book said.

When Marty had joined the Astronaut Corps, Earth Control still communicated with spacecraft via video links and television cameras. The video had gone when some bureaucrat had decided the bandwidth cost too much to maintain. Pure audio lasted for a few years, then someone else decided they could save a few nickels by sending all messages as text. They claimed it fit better with the computer controls, and allowed better error-checking protocols. The managers didn't care that an astronaut 270 million miles from home would rather hear a human voice trying to break through the crackle of static: money could be saved.

The message read as if it had been written by a lawyer. Perhaps it had: law degrees were the right credentials for management positions, even for the Russians. The block letters appeared on both of their workscreens:

"IN RESPONSE TO YOUR MESSAGE OF 1300 HOURS, 21 JULY 2053: YOU ARE TO ARCHIVE ALL SENSOR DATA REGARDING ASTEROID 12876 IN PERMANENT FORM ON A STANDARD LIGHTFILE DATA DISK. FOLLOW STANDARD PROCEDURE A7 IN "ASTRONAUT HANDBOOK" IN COLLECTION OF AFOREMENTIONED DATA FILES. HOWEVER, AS STATED IN YOUR MISSION CHARTER, IN ORDER TO SUCCESSFULLY MEET THE OBJECTIVES OF YOUR MISSION, AS SPECIFIED IN PERFORMANCE REVIEW PARAMETERS, DEMOLITION OF ASTEROID 12876 MUST BE COMPLETED ON SCHEDULE BY 1200 HOURS 22 JULY 2053. ANOMALOUS SENSOR DATA DOES NOT COST-JUSTIFY ALTERATION OF THIS OBJECTIVE. *SCIENTIFIC OBJECTIVES OF* MISSION ARE SECONDARY TO SECURING SAFETY OF PLANET EARTH BY DESTROYING POTENTIALLY HAZARDOUS ASTEROID 12876."

"I don't believe them, Marty!" Fern exclaimed. "Can't they see this is something we have to handle differently? Dammit, my orbital model shows no chance of impact for 10 million years, and that's as far as it can go. I sent them all that data. . . ."

Marty shrugged. No new managerial idiocy could shock him. "What did you expect? Nobody back on Earth gives a damn about what's up here. All they care about is having nice soft jobs, good pay, and lots of security. They fooled

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the public into thinking all these asteroids were bullets with '*Earth*' written all over them. Maybe they fooled themselves as well. They just want us to follow orders, no questions asked."

Fern didn't respond, so Marty went back to the game he was running on the viewscreen. He was tiring of seeking his way through the Levels of the Pyramid. Some new monster seemed to pop up at each turn, each more frightening than the last. Killing them used energy points, and he was running low on food. This time he had made it to the eighth level, but there were five more to go before he reached the peak of the pyramid. He didn't think he would make it this time, but someday he was sure he would beat the damn game.

The word "Interrupt" flashed on the screen in red letters, and the game vanished, automatically saved. It was not a message from the main computer; Fern had pushed the override. The new display showed the asteroid in three colors. A key on the left showed that each color corresponded to an infrared waveband from the laser radar; red was 10 micrometers, yellow was 3 micrometers, and blue 1 micrometer. The display cycled through all three, then superimposed them. Labels appeared, most near bright spots on the surface, reading, "*Apparent metallic debris.*"

Marty was annoyed. Normally Fern was the best of companions, spending her time working equation-puzzles, reading, or analyzing isotopic data she had collected from earlier asteroids. She never imposed herself on Marty and he had returned the favor. "Is this really necessary?" he asked.

"It sees metallic debris, Marty. Do you have any idea what that means?" It was a rhetorical question; she left no time to answer. "The Solar System didn't make shiny metals naturally. Something crashed there. We may have found what happened to one of the old Solar System probes."

"Oh!" Marty nodded, mildly interested at last. He was a space history buff. His parents had grown up in a Detroit slum thinking that men on the Moon were history, but they had lived long enough to see their son go there to fix a sick radio telescope. He longed for the good old days when the space program tried to make discoveries rather than a profit. His collection of space data included records on all the old probes that had gone beyond Earth orbit, dating back to the *Voyagers* and *Mariners*. He went to his private quarters, returning in a few minutes with an old-fashioned CD-ROM disk. The reader spit it out the first time, but recognized the format the second.

Fern's mind never rested. While Marty had looked for the disk, she had calculated the asteroid's orbit back to 1970, and was ready to compare it to last known trajectories for lost probes like Phobos 1. The CD-ROM data wasn't in the right format for that. Marty had to dump five-year chunks into memory and search for probes lost inside the outer limits of Fern's orbit. Few could have gone beyond Mars, and none came close to matching Fern's orbit.

She insisted on another search, and when that failed she borrowed the disk and ran her own. Nothing matched, even when she changed parameters to see if any outbound probes might have looped back, caught by the gravity of

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a planet. She went by hand through the whole list, stopping only when the controls began warning: "*Within 100-minute zone.*"

It was time to fine-tune the rocket to stay near the asteroid. Marty hit a button to quiet the alert. "So what is it?"

"I don't have any idea. You're sure this list is complete?"

"It's supposed to be. SpaceData covers everything but some early Soviet military launches, where nobody ever found any hard data after things opened up." He paused to think. "They might have missed a few launches from countries that never got heavily into space. But none of those ever got beyond the Earth's gravity . . . "

Fern displayed the images on the screen again. They were larger but still unresolved and mysterious. She punched a few keys, saying, "I'll run some image enhancement routines to see if I can spot sharp edges."

At 5,000 kilometers, they couldn't expect much. Their telescope and array detector were small, designed to find asteroids, not to image them. They both stared at their screens as the software tried to massage the incoming image data, but nothing useful came out.

Marty turned his attention to maneuvering the *McNair*. Slowing to a kilometer per second as they approached the asteroid had been easy. Its gravity was so weak that he had to cut the speed to under a meter per second to orbit it. The computers were up to the job, but the mechanics were getting touchy. The years had worn the valves in the fuel and oxygen lines; what should have been a smooth power adjustment tended to fade or surge. As they neared the rock, he had to watch the sensors and the computers. The opto-electronic processor automatically homed on a distant bright spot, but once it started seeing a disk—about 200 kilometers away from a two-kilometer asteroid—the processor became confused. When the engineers renovated the *McNair*, they would add newer processors that could handle the close approach automatically, but until then the ship needed a human pilot.

The challenge of hitting the right orbit was one of the few things Marty would miss on the ground. He had joined the Air Force to fly planes, and he still loved fine-tuned machinery. Motorcycles had given his father the same thrill, but they had been banned as unsafe for decades. The changes that crash-proofed cars and highways had taken all the fun from driving.

He almost forgot Fern and her mysterious metals as he slipped the *McNair* into a near perfect five-kilometer orbit, circling the asteroid so slowly that it hardly seemed to move. He lingered over the controls, almost wishing the job wasn't done. A few commands produced a display of orbital parameters: period 48,000 seconds, orbital speed 0.66 meter per second. It was no wonder the rock seemed to stand still beneath them. Its gravity was so feeble they circled it at walking speed.

A picture flashed on Marty's screen. "*Interrupt, override,*" was printed on the top. It was a view Fern had taken through their small opto-electronic telescope, looking down on a pile of metal, rocks, and other dark objects. The metal was bright but irregular, like chunks of

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sheet-metal scrap. "That's your metal?" Marty asked.

"Some of it," she replied. "I found two other piles within a couple hundred meters. All three looked pretty much the same. Sun and shadow angles indicate each pile is twenty meters across and maybe ten meters high. That picture makes the pile look higher because the sunlight is coming in at a steep angle. Have you looked at the metal closely?"

Marth hadn't, but he couldn't see any special patterns on the screen. "I don't see anything—"

"Much of it is smooth; some of it seems to be plates—"

"But that's impossible. Nature doesn't make smooth chunks of metal. Any kind of shiny metal is rare enough out here. . . . "

"You know what it looks like, Marty," Fern said. "We've both seen the Lunar Base scrap dump. I think we've been a little more careful than this, but whoever left it probably didn't expect visitors here."

"Nobody's been out here, Fern. We went through the whole damn SpaceLog archive. . . . "

"I wasn't talking about humans. People have wondered why nobody came to visit if the galaxy was full of inhabited planets. This says that somebody did come, but we never noticed on Earth."

Marty stared at Fern, open-mouthed. She had always seemed sane. Like most people he had long ago abandoned hope of finding intelligent extraterrestrials. A few crackpots still listened to old antennas, but radio noise had stopped serious work on Earth, just as scattered light hid the stars in city and suburban skies. The new generation had never seen the heavens, and could hardly be expected to care.

"There is absolutely no evidence," Marty began. He could show Fern records from his space history files that debunked every claim of alien visitors as the work of crackpots.

She didn't dispute that. Instead, she pointed to the screens that showed the junk pile. In space, she said, metal plates could remain shiny for millions of years. Long before protohumans climbed down from the trees, she suggested, visitors might have stopped on the asteroid to repair something, then left. Spectral analysis gave mixed readings; some rock, some complex organics, and many lines that didn't match the modest list of compounds in its memory. What should the spectrum of a trash dump look like?

Marty shrugged, accepting her argument for the lack of a better idea or the will to argue. "It figures, doesn't it, that the first evidence of aliens would be their garbage."

"It's not that strange. Most things that archaeologists and paleontologists find are dead bodies or somebody's trash. There may be footprints down there, too, but we can't see them from here. We've got to investigate. I've already sent a message to Earth Control."

Marty doubted the ground-bound bureaucrats would be happy. He wasn't sure he was. He remembered his father grumbling one time construction was stopped because a backhoe had uncovered an old outhouse pit. The state had sent out an archaeologist, who spent months sifting through the rotting remains. His father had never gone back to that job.

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"What have we got that can get down there?" Fern asked.

"Not much," Marty replied. The *McNair* was not designed to land anywhere; built in space, it could only dock with an orbiting Earth station. Their own tethered suits would take them only a hundred meters from the ship. The bomb-delivery robots were the only possibility, but they had been designed only to dig and to deliver bombs. Their vision systems were rudimentary; the only reliable guidance technique was direct human control. Their arms had a limited range.

Fern was guiding the first of the robots on its way when the message came from Earth Control:

> YOU ARE TO COLLECT AS MUCH DATA AS POSSIBLE AS QUICKLY AS POSSIBLE. RECORD ALL DATA ON ARCHIVE FILES FOR LATER STUDY. HOWEVER, SCHEDULES MUST BE KEPT, AND DEMOLITION MUST PROCEED ON SCHEDULE.

Marty was not surprised, but Fern was astonished. "How can they ask us to do that?" She raged for several minutes, forgetting the robot. Without external control, the machine slipped into a standard landing routine. It attached itself firmly to the rock, then began pinging it and reading the acoustic returns, searching for the rock's weak points. When Fern turned back to her screen, she read: "*Fault mapping in progress.*"

Still angry, she hit the *Override* button. The screen responded, "*Awaiting instructions.*"

Marty helped her shift the robot into surface mapping mode. No junk piles showed on the horizon, but they couldn't be far away. They ran the robot's descent recording through the pattern recognition computer until they found where it had last seen a metal heap. Then they pointed the machine in the right direction and sent it plodding on its way, gently so it would not launch itself free of the asteroid's weak gravity.

Progress was agonizingly slow. The asteroid was too small to collect much dust or small rocks, but it had some rough spots and a few large rocks. The robot picked its way carefully, and it was several minutes before the screen showed the first sign of metal, a glint as the robot scaled a high point. It reappeared a couple of minutes later, a little closer, but still out of focus.

The robot had not been designed for remote sensing. Its vision system used the old 1125-line HDTV standard, and had no telescope and little data storage. Fern was storing the gigabytes in the *McNair*'s central data archives, hoping later to make room for the rest of the trip archives.

She stopped the robot when the pile occupied most of her monitor screen. Large flat metal plates with smooth and ragged edges stood out, bright in the distant sun. Near the top was something pinkish that might have been a chair. What seemed to be dull blue foam was scattered throughout the pile. Fern ran a quick spectral probe and asked if they could send the picture back to Earth.

Marty paused to think. Their digital link home had several channels, but most were for automatic monitoring of the *McNair*. All were crammed tightly into 50,000 bits a second. Their communication channel was just 4,000 bits a second. Even with the best compres-

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sion algorithms, it would take minutes to send the picture, with no assurance anyone would bother to decode it. "Only with difficulty," he concluded.

"We have to Marty! It's the only way to convince them. . . . "

He nodded, unconvinced, but nonetheless began the coding procedure. Whatever happened, the bureaucrats were not going to be pleased.

This time it took an hour for the message to return. Marty could tell the ground-bound managers were not in a good mood. The message reminded him what one manager had said in an unguarded moment: human astronauts were considered a liability because they were not as predictable as robots.

ASTRONAUTS ARE REMINDED NOT TO OBSTRUCT COMMUNICATION CHANNELS WITH PICTURES. TELEMETRY WAS DISRUPTED DURING VIDEO TRANSMISSION. PICTURE IS UNINFORMATIVE AND CORRELATES 99.7% WITH LUNAR SCRAP DUMP 3. NO EVIDENCE. REPEAT. NO EVIDENCE. FOR NON-HUMAN ACTIVITY. PROCEED WITH DEMOLITION POSTHASTE. ASTRONAUTS ARE REMINDED THAT SCHEDULE DELAYS COST MONEY AND WILL RESULT IN LOSS OF PERFORMANCE BONUSES.

"They're insane!" shouted Fern, when Marty posted the message to her viewscreen. They had not waited idly for the message. Fern had studied the pile with the robot's limited sensors. The *McNair*'s sensors could break the spectrum down into tenths of angstroms; the robot's sensor bandwidths were broader than a thousand angstroms apiece. The *McNair*'s pulsed laser spectrometer let her measure fluorescence decay times from the ship on the dark side of the asteroid. It was slow going; she was learning only enough to realize that she needed to learn much more.

Looking up from his search of the robot documentation file, Marty grumbled, "you should have known that all along." The low bidder who had made the *McNair*'s five robots had met the absolute minimum of Space Cooperative specifications. The documentation, for example, was only nominally in English; it seemed to have been translated from another language by people who knew less about robots than engineers knew about English. The robot's hands were shaped to match the standard handles the Space Cooperative had installed on the surplus bombs it had inherited during the final stages of global disarmament. That meant the bombs could not get loose—and that the robots could not hold anything without a standard handle. Marty decided the lack of standard handles proved that aliens had left the debris, and began mentally composing a memorandum to that effect.

"What are we going to do?" Fern put the robot on *Pause* and released her seat belt to float across the tiny cabin. "We can't blow this up, Marty. I can't imagine why they want us to. This is an international treasure, the first proof of intelligent life elsewhere in the universe. . . . "

"What alternatives do we have?" Marty's voice was suddenly cold. He looked at the floating woman, realizing how little they understood each other. "They gave us a direct order. We tried to explain why that order shouldn't be

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carried out, but Earth told us to carry out the order anyway. Do you know what they do in the military if you disobey a direct order?" He paused for effect. "They court-martial you. If you're lucky, they kick you out with a dishonorable discharge and take away your pension."

"What do I care about your damned pension?" she snapped back. "I don't want to curl up and die somewhere counting dollars on a computer. Are you saying . . ." She stopped, out of breath. "Are you saying you would destroy these artifacts . . . ? Are you really saying that?"

"What alternative—"

"What alternative? Destroying them isn't an alternative. We've found something that the human race has spent hundreds of years searching for. And you want to destroy it?"

"I don't," Marty said flatly, hoping to defuse her anger. "I don't want to destroy anything."

She stared back, clearly not believing him. "What kind of game are you playing?"

Marty shook his head silently, looking down briefly, then back up at her. "Only the kind of game I have to play to be here, Fern. You play it, too, though maybe you don't admit it. Just follow orders, do your job, and they'll put you on the next spaceship out. But there won't be any need for people on the next spaceship out." He paused, breathing deeply, as all the contradictions of life and space rolled over him. He loved space, but now he was tired and wanted to go home. He had always wanted the future, but now his only future was retirement, which worried him almost as much as managerial wrath. He put his head in his hands.

Fern started talking about the need to preserve the artifacts for the future. Marty didn't hear the words, but they irritated him. He looked up, snapping, "What future? Do you believe in the future, Fern?"

Looking puzzled, she muttered generalities about the people who would come after them.

"Nobody is ever coming here again, Fern. We are the last people out here. Can't you see what is happening? The only adventures the groundlings want are on the videoscreens and in the stores. Humankind doesn't want hard work or challenges." Marty was a little surprised at his bitter tone. "You want to know why the folks in the states really supported their early space program? It was live entertainment. . . ."

Fern said he was crazy, but his words blazed on, fueled by decades of futility. "You think all those rich white people in their big comfortable houses wanted adventure for themselves? No way. They wanted to watch adventure, safe in their living rooms. Safe where nothing could really scare them. Blow up a few astronauts and they hardly made a dent in the daily video body count."

He paused, looking down at his screen, then around the cabin, and finally at Fern, who had strapped herself back in her seat. The first time he was in a spaceship, he had studied every feature in the cabin. Now they faded into a blur, pieces of furniture frayed with age. "Our ratings have been dropping, Fern. They're cancelling the show. If there's a job, robots can do it cheaper. And you know as well as I do that

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there's really no job out here. It's just an insane demolition derby."

"Then why are you . . . ?" Fern left her question hanging.

Marty shrugged his broad shoulders. "Maybe I wanted something better, once. Maybe I didn't understand at first. Maybe I don't care any more. Maybe because I had to do something. My parents were proud they never spent a day of their adult lives on welfare. They built things, and they wanted better for me. So here I am, the last player in the demolition derby, successful enough to live on welfare for the rich."

"Marty!"

"Let's just blow this damn thing up and get out of here!"

"I won't let you, Marty!" There was steel in Fern's voice, old-fashioned, rod-rigid steel. "I've disabled the bombs."

Marty knew Fern was not bluffing. She did not play games like that. That was why she had always been a staff scientist, never making even the tiny step up the ladder to spaceship captain when there had been more ships. Her face almost twinkled with triumph.

"You'll get us both fired!"

"I don't care."

"You wouldn't!" His anger showed in his voice. Why couldn't she let it slide? He had let her get away with things. Her surveys consistently took too much time; she had erased entertainment memory for data storage. He could have leaned on her for that; he probably should have.

"I will not let you destroy something that should be part of humanity's heritage." It was Fern's final statement as she turned back to her controls.

Marty started to step toward her, but changed his mind. It would accomplish nothing. The small woman with the short grey hair was not one to be intimidated by his 200 pounds and whatever power he carried as captain. More likely, she was taking over his controls, so she could steer the ship away from the asteroid and back home. He sat down hastily and began raising security levels and invoking password protection. The status display showed that Fern had taken the first steps toward departure.

The electronic duel lasted just over a minute. Marty had the keys to all the system locks; once he closed and barred the doors, it would take Fern weeks to penetrate the layers of protection and access control. He had always been careful not to use the coding schemes when they were not needed. He had told Fern it would build trust between them, but he knew that it kept subordinates from learning enough to crack the codes.

"Damn!" Fern cursed, realizing that they were stalemated. The two were silent for a long, long time, staring at each other, not sure what to say.

Marty broke the silence, hoping to regain some initiative. "Can we find a way to compromise?"

"I doubt it."

"What do you want, Fern?"

"I want to save these artifacts and tell the rest of the world about them."

"And you think I want to destroy them?"

"You said as much."

"I don't want to destroy them, Fern. I want to do my job, and that job is to make sure the asteroid is not a menace to the Earth. And if the managers decide

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the only way to do that is to blow the whole damned asteroid to bits, that's what I've got to do."

"That means you want to blow it up, Marty," she spat. "Don't play games with me!"

He had never seen Fern's temper before. Part of him sympathized with her. Once they had shared the same dreams, wanting to escape the chains of Earth. She still had dreams, but his had faded. He had seen too many carefully reasoned economic analyses proving that colonizing Mars was ludicrously expensive, that the Moon was only slightly less ridiculous, and that orbital colonies could never be cost effective. He wasn't sure the studies were right, but it didn't matter, because the people in charge wanted to believe them, and nobody else cared. Once it had been the young who dreamed; now it was only old people like Fern.

As captain of the *Ronald McNair*, he was responsible for its mission, however ludicrous that might be. Marty wondered if the management courses he had chosen to ignore would have helped. Were there any magic quick fixes for recalcitrant subordinates?

Fern had tired of staring at him. "Look, Marty, this is a stalemate, and you know it."

He nodded.

"Let me make a suggestion, then. Suppose we just pretend to blow it up? Then it will be there for our children to find—"

"You don't have any children, Fern," Marty said. He had children, but there would never be grandchildren. His sons lacked the attention span and the commitment to do anything but have a good time. Like the rest of the human race, he thought.

"That isn't the point, Marty. Someday, sometime in the future, somebody is going to come out again. . . ."

Marty shook his head. "They will never come again, Fern. It's too dangerous. Don't you read the reports? The risks of space travel on statistical average shorten life by 0.85 year. The groundlings aren't going to risk their precious little necks—"

"We did!"

"We're out of date, Fern," he grumbled. "We're out of touch with the 21st century. We didn't grow up rich and fat and happy like proper groundlings. My parents had to work their way out of the black ghetto. Yours came from Vietnam on overloaded boats as children, lucky to make it out alive. Those days are all over. Now everybody just wants to add a few miserable months to their affluent lives. Space is history."

Tears stained Fern's eyes. "Don't say it, Marty. I don't want to hear it."

"But that's reality. . . ."

"It doesn't have to be. We can keep it alive. We can leave the stuff here. Detonate the explosives and pretend to destroy it, but don't. We can fool the groundlings; they never look closely."

Bewildered, Marty shook his head.

"It will be easy, Marty. We just override the robots' programming. Normally they go pinging away to find the faults that run through the rock, then place the bombs in holes drilled so the explosions push the cracks open and break the asteroid into smaller pieces. There shouldn't be much cracking if we put the bombs above the surface in fault-free zones. The radiation monitors will

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pick up the blast, so it will look like a normal demolition."

"But it won't fly apart in pieces . . . "

"Sometimes they don't, at least not right away, because they have some gravity of their own. The original goal was to crack the asteroid enough that it would fall apart in the Earth's gravitational field, but when the groundlings don't understand that, the Cooperative promised to blow the rocks up. Besides, does anybody really look to check?"

Marty thought a moment and shook his head. A dozen radar tracking stations monitored the asteroid belt, but all they would do is sound an alarm if anything started coming toward the Earth. No one would ever look at the *McNair*'s data archives. "I still think you're crazy."

"No, Marty, I'm not. This is a treasure that we've got to save. I can't be sure that anybody else will ever find it, but we can hope. Maybe someday . . . maybe someone will go through old data and find what we saw. Maybe by then, people will be ready to go back into space to find it. And maybe if we're lucky they will know what to do with it."

Staring at Fern, he started to shake his head. The idea was insane. Yet maybe it was the answer. It would get Fern off his back, and let him complete the mission, at least as far as Earth Control was concerned. Nobody would ever notice that the asteroid wasn't totally destroyed. The monitors, if programmed correctly, would say the asteroid had been damaged enough that it would fall apart in a planet's gravitational field, although it remained partially intact. The asteroid would never approach Earth until long after he was dead. Finally, he nodded. "Only if no word ever gets out."

Once she agreed, the job was as good as over. She freed two bombs from their programmed inhibitions and assigned robots to deliver them. Marty watched, but did not interfere. He had started the sonar sensors; it was Fern's job to interpret their outputs.

Marty copied Fern's screen onto his display. The screen showed fault patterns as blue streaks running through the white-outlined rock. Flashing red spots were fault foci. Putting bombs there, the computer believed, would shatter the asteroid. Fern was overriding the system to send the robots to places away from blue fault lines and the red spots.

Watching the sabotage, he wondered what would happen if they were discovered. He wanted to leave the entire job to Fern, but he had to help if they were to meet schedules. He steered a robot into the bomb bay and picked up a disabled weapon. If someone analyzed the data files carefully, his trail would be covered. Fern was the one who overrode the robot programs to put their two smallest bombs in safe places, far from the relics. They placed four disabled explosives, so the records would show they had installed the standard half dozen. The distant radiation sensors detected nuclear explosions, but they could not tell how many occurred; the bombs were leftovers from the arms race, so old their yields varied widely.

They left orbit an hour late, bombs armed and ready to fire in twenty-four hours. They were the proper ten thousand kilometers away when the explosions came. Fern monitored the blasts, careful not to take too much quantitative

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data. Anyone who studied the files would consider the data recording sloppy, an acceptable mistake when schedules were tight because it wouldn't cost the Cooperative money.

Fern turned off the data recorders and checked the sensors. The asteroid was intact. She flicked the recorders back on. "I wonder why they left the stuff there?" she asked, turning away from the display.

Marty shrugged. "I guess it looked like a good place to put the garbage."

"I'll find out later. I'm going back. I don't know how, but somehow I will get back. I'll copy the tapes and show them to people—"

Alarmed, Marty interrupted, "but you promised not to tell—"

Fury surged through her tongue. "Don't you care about anything beyond yourself? I'm not looking to betray you. I just want to save the dream. Remember the dream, Marty? Remember the dream you had when you were young? Remember the dream that brought you here?"

Sighing, Marty closed his eyes and nodded slightly. The thoughts brought tightness to his throat and moisture to his eyes. "I can if I try hard enough," he said softly. "The years have left so many scars that I have to try very hard now. Sometimes I think I was a fool then . . ."

"It's never foolish to dream."

"It would have been an easier life without it, Fern," he said sadly. "There are lots of easier ways to make a living."

"But it would have been a poorer life, down among the groundlings."

"Probably," he sighed, "but that's where I'll be soon enough." He had had little rest in the past two days, and he was too old for such things. Exhaustion was replacing his last wave of exhilaration. "I've done as much as I can. I'm almost finished with my rehearsals for retirement. It's all yours," he gestured at the controls, rising. "I'm going to sleep." ■

●The real problem is not whether machines think but whether men do.

Burrhus F. Skinner

●The follies a man regrets most in his life are those which he didn't commit when he had the opportunity.

Helen Rowland

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The Alternate View

FTL PHOTONS

John G. Cramer

Albert Einstein taught us that **c**, the speed of light in vacuum, is nature's ultimate speed limit, the highest speed at which matter, energy, and information can travel through spacetime. In several AV columns I've discussed ways for getting around this annoying natural law, the one that SF writers and fans most wish to violate. Two AV columns discussed the possibility of getting around the lightspeed limit by popping through a transpatial wormhole shortcut (see *Analog* June 1989, "Wormholes and Time Machines" and *Analog* May 1990, "Wormholes II: Getting There in No Time"). Two others discussed the possible use of the faster-than-light nonlocal handshaking implicit in quantum mechanics for FTL messages and travel (see *Analog* Nov. 1986, "The Quantum Handshake" and *Analog* Sept. 1988, "Paradoxes and FTL Communication"). Both of those methods, however, are beyond our present technology, and the latter is probably impossible.

But now we may have a new possibility. No serious physicist, to my knowledge, has ever suggested that it might be possible to make photons travel faster than **c** through empty space. Faster-than-light light seems a contradiction in terms. But this changed last February when K. Scharnhorst of the Alexander von Humboldt University in East Berlin published some new calculations indicating that, under the right conditions, photons of light can be induced to break the light-speed barrier.

Before I bring down on myself a flood of objections from readers knowledgeable about wave velocities, let me say that I am *not* talking about the difference between the group velocity and phase velocity of light waves. I'll pause, however, to explain that distinction first. It's well known in physical optics that a "wave packet" may travel at a different speed from the individual waves from which it is formed. The crests and troughs of a light wave with frequency **f** and wavelength **L** travel through space with a speed called the *phase velocity* and given by the product (**f** x **L**). If, however, you want to use light to transmit a packet of information or a burst of energy, you have to put together a band of such waves of different frequencies. The wave packet containing the energy and information travels with a speed that depends on how frequency varies with wavelength over the transmission band. This quantity is called the *group velocity* and is given by the derivative **df**/d(1/**L**), the rate at which the wave frequency **f** changes when the reciprocal of wavelength 1/**L** is varied. In free space the group and phase velocities are identical and are both equal to **c**, but in a dispersive medium where the transmission speed depends on wavelength, the group and phase velocities can differ both from each other and from **c**.

For example, microwaves are high-frequency radio waves (or low-frequency light) with wavelengths of a centimeter or so. They are used in

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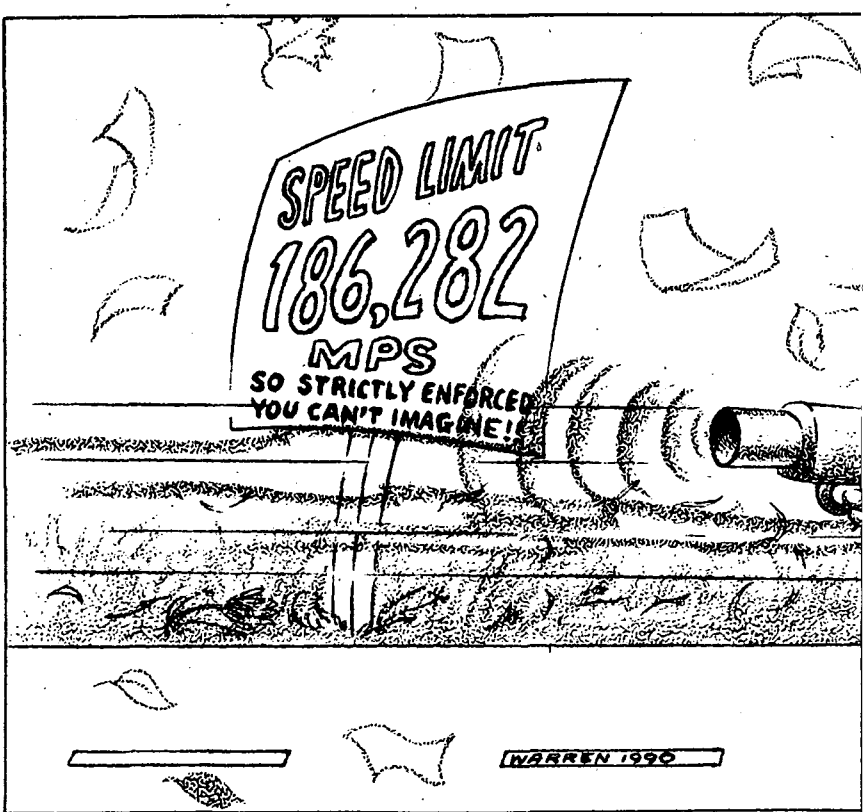
applications ranging from aircraft radar to police speed measuring devices. The phase velocity of microwaves travelling inside a waveguide (a square pipe used in microwave plumbing) is considerably *larger* than **c**. This is because there is a cavity resonance in the waveguide at a slightly lower frequency which elevates phase velocities on its upper frequency-slope. But a wave crest is not a signal. Nature, while permitting FTL wave crests, consistently refuses to allow signals or energy to travel FTL. It's always the case, even in wave guides, that the group velocity is less than or equal to **c**.

The effect that Scharnhorst's paper discusses is independent of frequency and wavelength, and so is not the result of dispersive (wavelength-dependent) effects. Phase and group velocity are equal and increase together. Scharnhorst's effect is a consequence of quantum electrodynamics (QED), the quantum theory of light and electromagnetism. The theory of quantum electrodynamics tells us that empty space, when examined on a very small distance scale, is not empty at all; it seethes with the fireworks of *vacuum*



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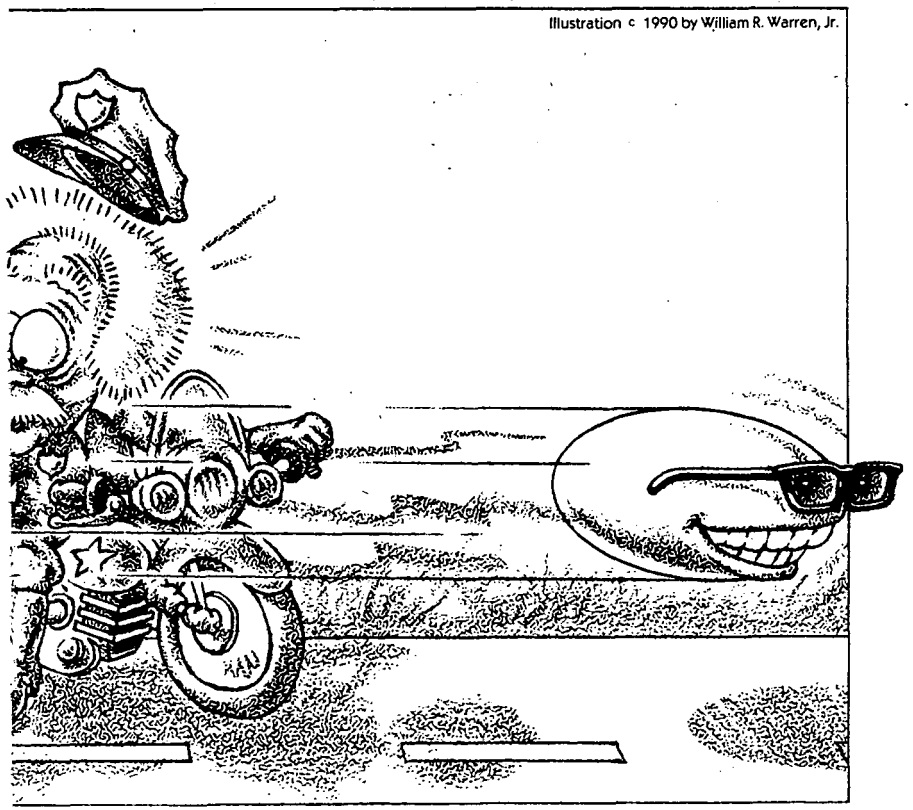
fluctuations. Pairs of "virtual" (energy non-conserving) particles of many kinds continually wink into existence, live briefly on the energy credit extended by Heisenberg's uncertainty principle, and then annihilate and vanish when the bill for their energy debts falls due a few picoseconds or femtoseconds later. The seemingly smooth passage of a photon or electron through space, at the QED distance scale, is revealed to be a punctuated chain of interactions and transformations involving virtual particles.

For example, a travelling photon may briefly be transformed into a virtual electron-position pair, which moves forward less than one photon wavelength before annihilating to create a new photon indistinguishable from the old one. During the photon's brief existence as a pair, one of the virtual particles may initiate a "game of catch" using a virtual photon as the ball, tossing it one or more times to itself or its partner. These QED complications of the smooth passage of photons through space have the effect of making the photon travel more slowly. In part, this is because the photon spends a fraction of its existence as an electron-positron pair which can



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only travel at sub-light velocity.

There is, however, a way of suppressing part of the vacuum fluctuations, of making "empty" space more empty, using a technique based on the *Casimir effect*. If two conducting parallel plates with no electrical charge are placed very close together, the presence of this pair of conducting walls suppresses all virtual photons with wavelengths larger than twice the plate separation distance, because the wave structure of such a photon would intercept the walls in less than half a wavelength and the electric field of the wave would have a forbidden non-zero value within the conductor. Thus, the more closely the plates are spaced, the broader becomes the spectrum of virtual photons that are suppressed, and the vacuum between the plates becomes "emptier" of vacuum fluctuations and lower in energy density.

Since the energy density of normal vacuum is defined to be zero, the vacuum between the metal plates actually becomes a region of *negative energy density*. The amount of negative energy increases as the plates are brought closer together, so there is a physical force pulling them together which can do work (like lifting a weight) on an external system. This force, though very weak, has been measured in the laboratory. The experimental observation of an attractive force between two electrically neutral metal plates is an experimental confirmation of one of the more bizarre predictions of QED and is called the Casimir effect.

Scharnhorst has given a new twist to the Casimir effect by considering the velocity **v** of a photon travelling across the gap between the plates. If the plates are separated by a gap **d**, the Casimir effect suppresses all virtual photons with a wavelength of **2d** or greater. Because these virtual photons are absent, they cannot participate in games of catch between virtual particles. Therefore a real photon travelling between the plates spends less time as an electron-positron pair because the QED vacuum fluctuations are suppressed. For this reason, the photon travels faster across the gap. Its speed of travel through normal vacuum is **c**, so its speed **v** in the negative energy vacuum between the plates is *greater than* **c**! Einstein's lightspeed barrier has been broached by a photon!

OK, that's the good news. The bad news is that in reasonable experimental situations, the Scharnhorst effect is not very big. In fact, it's abysmally small. With a plate gap of **d**, $v/c = 1 + (1.6 \times 10^{-41} \times d^{-4})$. If we made **d** as small as experimentally possible, say 1 nanometer ($= 1 \times 10^{-9}$ m) or about ten atomic diameters, we find that $(v-c) = 1.6 \times 10^{-24}$ **c**.

This is an unmeasurably small change in the velocity of the photon, and only for a very small travel distance at that. But even such a small boost in speed comes as a surprise to those of us who had considered **c** as the ultimate speed limit. Moreover, special relativity says that if in one inertial reference frame an object travels only one part in 10^{24} times faster than **c**, one can find another reference frame in which the departure and arrival times of the object are simultaneous and therefore the velocity is *infinite*.

And, with heroic measures, one might

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boost the effect. Scharnhorst's calculation raises some interesting questions about limiting situations. Light in normal space is "slowed" by quantum fluctuations which cause it to spend part of the time as an electron-positron pair. It travels slightly faster in the space of lower (and negative) energy density between the Casimir plates, where part of the quantum fluctuations are suppressed. In circumstances achievable in the laboratory, this increase in speed will be very small. But what about outrageously extreme circumstances? The problem of doing better than the laboratory situation is that normal metals are made of atoms which become very lumpy and non-planar at the nanometer scale. So let's use something else, something smoother, something non-atomic. Suppose, for example, that we make a pair of Casimir plates from superconducting neutronium. Or perhaps the two-dimensional equivalent of cosmic string, a "cosmic wall." Cosmic walls, if they exist at all, are supposed to be smooth down to Planck-scale dimensions (10^{-35} m) and also are perfect superconductors. Suppose that between two such plates we make a gap on the order of nuclear dimensions, about a femtometer (10^{-15} m). If one takes Scharnhorst's equation for index of refraction at face value, c/v goes to zero and a photon travels at *infinite* speed when the gap between the plates is decreased to about 1.13×10^{-15} m, or about the diameter of a proton. Of course, the approximations used in the calculation may not be valid because of higher-order effects at such small distances.

Nevertheless, such calculations serve to illustrate the point that once the light-speed barrier is breached, physics becomes very strange. And perhaps there are other, simpler ways of suppressing vacuum fluctuations and creating a region of space with a negative energy density. Suppose that we could create a large bubble of space inside which there exists the same negative energy density and suppression of vacuum fluctuations that is present in the above example, where the pair of Casimir plates is separated by a femtometer. Put such a bubble around a space ship and the ship can presumably travel within the bubble at any desired speed. And now suppose that we can move the bubble along so that it paces the ship . . . It would seem that we have a FTL drive that is consistent with special relativity and quantum electrodynamics.

One should not get too excited about these prospects until Scharnhorst's calculations are verified and expanded. But at least it appears that a small chink has appeared in Einstein's previously impervious lightspeed barrier. ■

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TURKEY DAY

William S. Davis

This is, of course, mere fiction. No *real* government would do anything like this . . .

William R. Warren, Jr.

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"Mr. Simpson. You are in charge of the TTFE project; is that correct?" Senator Berry sounded annoyed.

Tom Simpson's collar felt tight, and the TV lights were hot. He wanted desperately to wipe his forehead, but that would not look cool. He cleared his throat and started to speak. "That's right, Mr. Chairman." His voice cracked. He felt his glasses slipping down his nose. He took a deep breath and continued, "I am the assistant to the deputy director for Health and Human Services, Office of Nutrition, Special Ad Hoc Events. In that capacity, TTFE, Senator Marshall's *Thanksgiving Turkey for Everyone* project was my responsibility." That felt better. He was in control now. He smiled at the senator.

"Please don't link that disaster with Senator Marshall, Mr. Simpson," snapped Chairman Berry. "His bill was a good one; I voted for it myself. The purpose of this subcommittee hearing is to discover how your office turned his first-class idea into an embarrassment to this government. Indeed, to this nation."

"It certainly was!" interjected Senator Marshall. The elderly gentleman, his back rigid, his snow-white hair a calculated mess, his mustache aquiver, leaned toward his microphone. His steely eyes gazed directly into the C-SPAN camera.

"I got the idea on Thanksgiving night two years ago," he went on, jabbing a finger at Tom. "The evening news had a report about the Salvation Army giving free meals to the poor. Wonderful people, the Salvation Army." He paused, nodding his head slowly. Then he continued in a quiet, dramatic voice.

"The next report showed a group of homeless people with nothing to eat but a can of beans. Beans! On Thanksgiving!" Senator Marshall's voice had climbed a few decibels. "This is America!" He slammed his fist on the table. "Thanksgiving is an *American* holiday. Every American, without regard for race, religion, national origin, sex, sexual preference, or political orientation has a *right* to a good, old-fashioned American turkey dinner on Turkey Day." Slowly, Senator Marshall sat back, his eyes fixed on Tom, a scowl on his face. "Especially in this first year of a new millennium," he finished. Scattered applause rippled through the conference room.

Chairman Berry rapped his gavel. "Order, please." He allowed the cameras to linger briefly on Senator Marshall; that image of the angry but dignified old man would look great on the evening news. Then he continued. "Senator Marshall, you may begin the questioning."

The white-haired gentleman stared at Tom for a few seconds. Finally, his voice dripping with disdain, he announced, "I am a bit too close to this issue to be objective, Mr. Chairman." He broke eye contact with Tom. "I yield that honor to my esteemed colleague from Texas, Senator Lopez."

"Thank you, Senator Marshall." Senator Lopez reached into her briefcase and pulled out some papers. She, too, stared disdainfully at Tom for several seconds, saying nothing. He squirmed; that would *not* look good on

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the evening news. "Let's start with the budget," she said, finally. "According to my figures, you spent a total of 1.5 billion dollars on this project during fiscal years 1999 and 2000. Is that correct?"

Tom reached for his own briefcase, extracted a report, and paged through it quickly. "That is approximately correct," he replied. "The exact total was—"

"One point five billion is close enough, Mr. Simpson," she interrupted. "How many people did you feed on Thanksgiving Day, 2000?"

"Our target was one million."

"How many did you actually feed, Mr. Simpson?"

"I really don't know, Senator. There were problems with the count."

"Never mind. If I use your official target, the cost of this project works out to $1,500 per meal. Doesn't that strike you as expensive for a turkey dinner, Mr. Simpson?"

"It was a new program, Senator. That figure includes substantial start-up costs. Those costs are behind us. We should be able to bring the cost down to no more than $500 per meal next year."

"Five hundred dollars per meal is not a very impressive target, Mr. Simpson, but let's focus on the project to date. How much of that $1,500 was actually spent on food?"

"Including processing?"

"No, Mr. Simpson. Just tell me what you spent to buy the food. What was your grocery bill?"

Tom flipped through a few more pages. He pulled a pen from his shirt pocket and did some quick calculations. "In total, or per meal?" he asked.

"Per meal." replied Senator Lopez.

Tom did another calculation. "$3.42"

"That leaves . . . " Senator Lopez did a calculation of her own. " . . . $1,496.58 per meal in non-food expenses. That is incredible, Mr. Simpson. Why didn't you just award a grant to the Salvation Army?"

"They are a religious group, Senator."

"Why didn't you just give each of those million people $20 and let them buy their own Thanksgiving dinner?"

"We can't do that, Senator. We could never account for the money. Besides, there would be no way of ensuring that the recipients actually spent their $20 on a turkey dinner."

"Perhaps, Mr. Simpson. I'm sure your agency can *account* for every dollar. Maybe you can explain to this committee how you managed to spend $1,500 per meal?"

Surrendering all pretense of coolness, Tom wiped his brow with a handkerchief. "Well . . . " He fumbled briefly with his papers before looking up at Senator Lopez. " . . . As I started to explain earlier, Senator, there were numerous start-up costs associated with this project."

"For example, Mr. Simpson," prompted Senator Lopez.

"For one thing, that incident in Tulsa really complicated matters."

"That's my state," thundered Senator Pridemore. "To what incident do you refer?"

Tom stared at the senator from Oklahoma. Surely Pridemore knew about *the* incident? He felt a little better; he was not the only one who would look bad on television. Still, this was no place

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to challenge a senator. "On Thanksgiving Day, 1999," he replied, "two skinheads on a public access channel were discussing the Turkey Day project. One of them said something about looking forward to eating some 'free dark meat' next Thanksgiving."

"So?"

"It was a racist remark, Senator."

"I recall that incident," said Senator Pridemore. "It led to some much needed changes in public access rules. What I don't understand is how it affected the turkey program."

"Perhaps, Mr. Simpson," said Senator Lopez, resuming her line of questioning, "you could explain that to Senator Pridemore."

Tom relaxed a bit. The connection was *obvious*. He was going to win this exchange. "It struck us that certain elements saw the distinction between dark and white meat in racial terms," he began.

"Racial terms, Mr. Simpson?" interjected Senator Pridemore. "That is absurd. I have been eating turkey for over sixty years, and I have *never* thought of dark and white meat in racial terms."

"The two young men in question certainly did," countered Tom.

"Those two young men see everything in racial terms, Mr. Simpson. They are hardly representative of the good people of my state."

"I'm sure you're right, Senator. But they did intend their comments as a racial slur. That was clearly unacceptable, so we decided to eliminate the distinction between dark and white meat."

"Come now, Mr. Simpson? Dark and white meat taste different."

"We decided to homogenize the turkey meat so that there was no physical difference between dark and white meat, Senator. The process eliminated the taste difference as it eliminated the color distinction."

"I'm almost afraid to ask, but how did you 'homogenize' the meat, Mr. Simpson?"

"We used gene splicing technology, Senator."

"You mean you bred a new kind of turkey?"

"No. We used a bacterium to separate the meat from the bones and the skin. Then we used an emulsifier to liquify the meat at high temperature, and we blended the dark and white meat. When it cooled, it solidified to an appropriate texture."

"What did you get? Grey meat?" interjected Senator Marshall. A ripple of laughter passed through the committee room. The chairman rapped his gavel.

"Actually Senator, it was more beige," replied Tom, a serious look on his face. The laughter started again. The gavel rapped again.

"Why didn't you mix dark and white meat on everyone's plate?" asked Senator Lopez. "Or randomly hand out dark and white meat dinners? Homogenizing meat sounds like an absurdly complex solution to a simple problem."

"We considered that, Senator. But there would still be a distinction between dark and white meat."

"Homogenized turkey sounds terrible. How did it taste?"

"Good," replied Tom. "I tried it myself."

"Did it look like turkey?"

"That was a problem initially," ad-

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mitted Tom. "But we solved it by pouring the liquefied turkey meat blend into small, 6.5 ounce turkey molds."

"Six point five ounces?" queried Senator Marshall.

"That's the federal standard for a single serving of turkey," continued Tom. "After we molded the meat, we stuffed the little turkeys and wrapped a piece of surplus cheese around each one."

"You stuffed them?"

"Yes. There was a little bulb at the rear of the mold. That left a cavity big enough to hold 3.8 ounces of stuffing. The artist who designed the mold was very good."

"In other words, you jammed stuffing up the turkey's a—posteriors."

"Where else would you stuff a turkey, Senator Marshall?" Tom regretted his little joke as soon as he said it.

"Why the cheese, young man? I never remember my mother or my wife wrapping our Thanksgiving turkey in cheese."

"Two reasons, Senator. First, we were mandated to use surplus foods—"

"Surplus foods, Mr. Simpson?"

"To save money, Senator. Second, after we applied the cheese wrap and froze the turkeys, the cheese turned grey and bubbled. It looked like real turkey skin. We wanted a natural appearance. In fact, the people who make Spam have expressed an interest in the process."

"Let's get back to finances," Mr. Simpson," said Senator Lopez. "Obviously you spent some money preparing the food, but I still can't understand $1,500 per meal."

"First there was the research, Senator; it was very expensive. We had twelve different universities looking into various aspects of this problem. Incidentally, that research was the basis for several master's degrees and Ph.D theses. Then there was the FDA testing. The design competition for the turkey molds. The tool and die work; that was a special order. The nutritional consultants. I could go on and on."

"I'm sure you could, Mr. Simpson. Research can't explain all the costs, though, can it?"

"Oh, no, Senator Lopez. The TES was probably our biggest expense."

"TES?"

"I apologize, Senator." Tom smiled briefly before continuing. "TES is TTFE slang for *Turkey Eligibility System*. It was a national, on-line computer system to verify the eligibility of each applicant for a turkey dinner before he or she was allowed into the dining room."

"Was that really necessary, Mr. Simpson?"

"Unfortunately, Senator, there are people who take unfair advantage of federal programs. Senator Marshall's bill specifically limits this benefit to persons whose incomes for the previous year were at or below the official poverty line. We used the system to verify reported earnings for the prior year."

"Granted, Mr. Simpson, but that's not the point. Did you really need an on-line computer system? Wouldn't a card showing eligibility for other federal services do?"

"Those cards can be faked, Senator, and we couldn't afford to take that chance."

"Why not just trust the people? At . . ." The senator paused and checked her notes. "At $3.42 per meal in actual food costs, you could have

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served *ten* million people for less than you spent."

"That would have been a violation of the law, Senator. Only people who are eligible for a benefit can receive it."

"Where else did the money go, Mr. Simpson?"

"The transportation system was another major expense."

"Transportation system?"

"Many of the people who are eligible for this benefit live in the inner city, Senator. Government buildings were closed for the holiday, and the downtown hotels were too expensive, so we had to use suburban hotels. That meant we had to bus the people to the hotels."

"I can't believe that bussing was cheaper than renting space in a downtown hotel."

"You're right, Senator Lopez," conceded Tom, "it was much more expensive. But the way our budget was structured, the amount we could spend on rent was limited. We had the money to cover the bussing costs. What else could we do?"

"Why not use churches?"

"The government can't use churches."

"I see. Were there any other big expenses?"

"Labor was a killer. Holiday pay means double time, so we were paying the bus drivers, the servers, and the TES terminal operators at least thirty-five dollars per hour. It's not fair to compare us to groups like the Salvation Army because they use volunteer labor."

"So you spent 1.5 billion dollars on one meal."

"The way we see it, Senator, we kept the cost of a complex new federal program to only 1.5 billion dollars. A lot of people in my agency worked very hard on this project, and we're proud of what we accomplished."

"You're *proud?*" thundered Senator Marshall, thumping the table. "The citizens of my state were not impressed with your dinner, Mr. Simpson. That is the real issue, sir. Quality, not cost."

The senator's outburst startled Tom. He wiped his forehead again to give him time to collect his thoughts. "The response was mixed," he admitted, finally.

"Mixed, my eye! They took those silly damn turkey molds and threw them against the wall. Turkey crap all over the place. Then they stomped out and went over to the Salvation Army. Biggest black eye this government's received since Japan cut off our credit. I was ashamed to have my name associated with this, this—"

"I would like to hear your explanation, Mr. Simpson," interrupted Chairman Berry, exerting his control over the committee. "Do you have any idea why the people responded so negatively? The program was designed to help them, but near riots like the one Senator Marshall just described were widespread. In some centers, the people actually threatened the servers. What happened?"

"We're not sure, exactly, Mr. Chairman. For one thing, there were problems with the TES system. It took hours to verify the eligibility of everyone who showed up. Apparently, people were tying up the telephone lines to make personal calls—"

"Of course they were. It was Thanksgiving," interrupted Senator Pridemore.

" . . . and that slowed the system

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down," continued Tom. "In a few cases, we couldn't start serving until an hour or more after the scheduled time. Maybe they were hungry. The food was cold—"

"And it tasted like a well-known barnyard by-product," shouted Senator Marshall. "I saw the crap you served those people. My pigs wouldn't eat it."

"The important thing is to see that this never happens again," said Chairman Berry.

"Agreed," said Senator Marshall. Once again he looked directly into the C-SPAN camera. "Next year, your agency won't be involved, Mr. Simpson. Next year, Turkey Day will be managed by a new ad hoc subcommittee of this subcommittee of the Human Rights Subcommittee of the Health and Human Services Committee of the United States Senate."

Around the table, the other senators nodded their solemn agreement. ■

●The art of being wise is the art of knowing what to overlook.

William James

●People sometimes have the attitude that "Gaia will look after us." But that's wrong. If the concept means anything at all, Gaia will look after *herself.* And the best way for her to do that might well be to get rid of us.

Jim Lovelock

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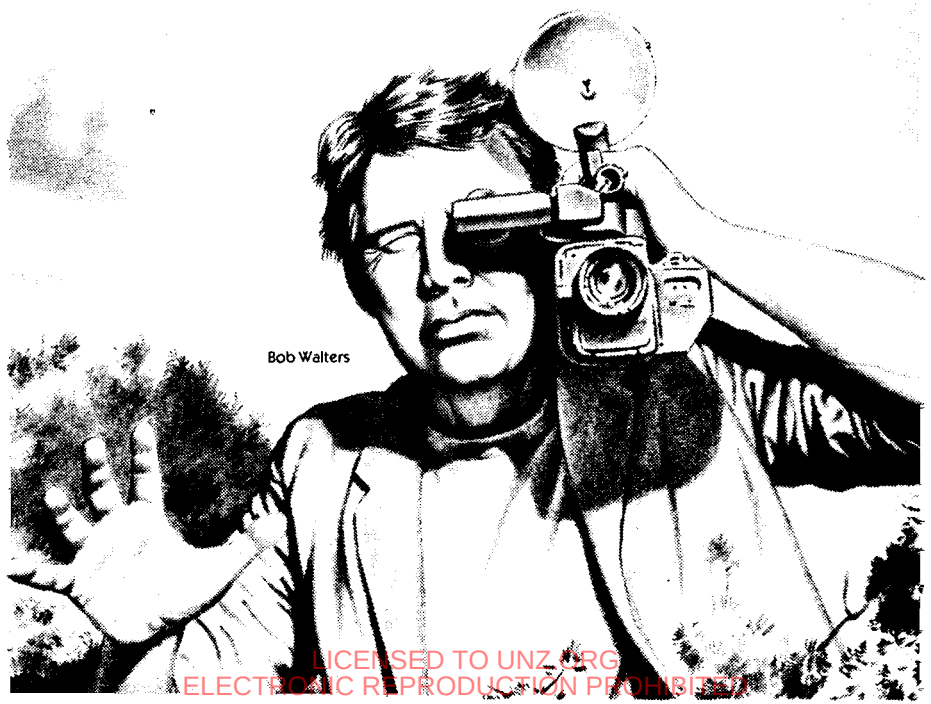
THE MAN ON THE SPOT

Bob Buckley

Any reporter knows on-the-spot coverage is best—but sometimes the story is bigger than he bargained for!



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The thunder and howl of the approach is deafening, a terrifying shouting roar. The tapered funnel whirls through clusters of homes and stores, pogo-sticking destruction down the length of Main Street. Frame walls and shingled roofs, plywood sheds, the brick-faced fossil of the boarded-up REXall drug emporium, all shivered, then exploded from within like bombs of clapboard and shingle, sending glistening showers of broken glass fountaining into the night as the tornado, its gray and wrinkled trunk darting malevolently here and there, rushes eastwards. The deafening passage quiets as it enters a patchwork of fields beyond the devastated town. The abrupt silence is ghostly, but not complete. It is broken here and there by rustles of shifting debris, the blue-white crackle of downed power lines spark-dancing across drowned lawns heaped with severed branches and a litter of chairs and TVs. A board moves beside an overturned Buick and a hand wriggles out. The woman emerges warily, a slow inch at a time. Blood has run into her eyes and her face is a white mask slashed with scarlet as she worms from the collapsed basement. Above her in the purple-black sky stars peep through holes in the cloud cover, and something else . . . a brighter glow darting around like a dog on a scent. As if hitting a spoor, the light dips from the clouds revealing itself as a metal ovoid whose surface is crawling with a sheen of violet energies. A nest of minute lenses works on its front as it hovers only inches from the woman's contorted face, prompting a frightened shout and a flood of tears, all of which are hungrily recorded. . . .

* * *

1

Edwin Tyler fought back a bad case of the shakes, standing "naked" before MacKenzie. The corporate elements had dared utter the dreaded "C" word and his noteboard was slippery in his sweating hand, the AI tablet full of ratings demographics, of viewer profiles . . . full of WALTER. *Just listen, please*, he wanted to shout, frantic over the impending loss of a career . . . and some very healthy residuals, and even more frantic that Mackenzie wouldn't listen when he made his pitch for WALTER's latest exposé. It was the 700th floor of the Carson Building, News Director Land, and Tyler cringed involuntarily as MacKenzie held up a fistful of letters, one of them artfully done in crayon on a shirt back, and finished his tirade with: "Damn it, man, you've offended your last idiot fringe! You're off the air, Tyler. That's final!"

"Mac, I've been good for this network, the ratings were always solid, we made money. Then one bad season and suddenly I'm out like poison. What kind of loyalty is that?"

"Loyalty? Loyalty! The hell, man, this is television." MacKenzie Glenn was young, prematurely bald, fashionably dark, the two thousand dollar suit and resurrected hair slick talismans of his success and power. The news director pulled in air through clenched teeth like a lizard choking on a bad fly, and glared at Tyler as much in defense as anger. "You were *supposed* to make money. While you did you were hot. Now you aren't. You've lost your audience. You're canceled."

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Tyler flinched involuntarily, holding the interactive board in front of him like a shield, hoping the words would bounce off before they stuck in his consciousness, knowing, as others in his situation had discovered to their eventual ruin, that if he started to believe them he'd be dead. It didn't help that WALTER's grizzled visage was frowning at him from the noteboard screen, mouthing: *Fight back, tell him. Do it!*

Hell, what did he have to lose? He was already canceled. He took a deep breath and pitched: "Look, Mac, last year was slow news, but there's this place out in the midwest, weird things are going on there. WALTER," he tapped the noteboard for emphasis, "has it figured. So we do a remote, the upside is we get the jump on everybody. Requires a driver, a van with broadcast unit and uplink capability. Once they hear about it sponsors will be killing for a share of broadcast time. Mac, we'll be first on the air with in-depth coverage of what the Enquirer network is calling ovoids."

MacKenzie's young-old face twitched with anger. "Ovoids are tabloid bullshit, Tyler. Next you'll be babbling about alien ships orbiting the Moon."

Actually, an observatory in Wolong Goola, Australia was reporting just that, but that was another remote. Instead of responding he keyed the noteboard, flipped its screen around toward MacKenzie to let WALTER do his own spiel, that fatherly face radiating trust, scholarly delivery paced to perfection, quoting ratings estimates and predictions of viewer responses plotted against standard deviations of interest percentages, purchasing power, and debt ratios and Mac was sucking it up, wide-eyed. But Tyler was so eager to get on with the sale pitch he almost stepped on the AI's last line, blurting: The interest factor is there, MacKenzie, one bil return, minimum, with guaranteed major sponsors from the big three: light beers, suppositories, and feminine napkins. What do you say? Do we have a remote?"

"Remotes are reserved for special events," MacKenzie said cautiously, and sank down into a techies' dream-womb of New Zealand leather and brushed chrome. His eyes flicked at his desktop, which Tyler hoped was giving verifying data on the demographics. They had a jump on the story, but that wouldn't last long, not with the wire services heating up with accounts of terrified eyewitnesses blabbering about flying golden balls with eyes.

"You're sure about this?" MacKenzie picked up a pencil and eyed the eraser end speculatively. It was already well-chewed so he put it down and went back to staring at Tyler.

"Sure as anything. Give me Prime-time break-in rights and I'll have 'em grabbing their chairs and gulping commercial spots just to see what I've got coming next."

"I don't know. . . ." MacKenzie's face became unreadable and Tyler felt his heart thudding fit to break out of his chest and do a jig around the room. Suddenly it was hard to breathe. "Your WALTER could be wrong. It's only an AI."

"Was he wrong about the Juarez massacre?"

MacKenzie shuddered and stood up, turning to stare out the arch of window wall behind him. The Apple loomed

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beyond, bright metal, dark glass, turgid air burning red-gold at noon. "Sometimes I wish he had been. We had people in Honduras that got caught in the retribution. OK, Tyler, you've got a second chance. See Spencer about a van,"

Tyler gulped, repressing an urge to shout with joy. There *was* life after death!

2

He should have been pumped over his victory. Instead, Tyler found himself chewing his lip and glaring out a window at the passing scene. The truth was he hated remotes. Remotes occupied the same cerebral cubby of his skull as appointments in an orthodontist's stale waiting room out of his youth. With a remote you hit and got out fast, before the decaying, musty hotels trapped you, before the slick, suavely greedy inhabitants of backwoods venues saw you as something other than quick cash. Remotes could kill you. It was only because they could feed you too that he did them. It was a simple logic called survival.

It had taken them six hours to get out of New York, escaping clogged arteries of congealed traffic. Twelve more hours on air cushion riding the maglevs with Tyler napping. The driver had put down the wheels just past the Ohio River and now he could feel the road, which was unfortunate because the seventy-year-old concrete was disintegrating. Outside the windows were clutters of frayed suburbs and relic forests preserved like monuments, acres of blackened sticks scraping at the sky. Eastern Iowa humped itself into monotonous vistas of fallow fields that carpeted a sprawl of ancient hills. Here and there a white clapboard farmhouse stood out in stark isolation. Tyler sipped fine aged Kentucky spirits as the landscape slid past like a painted backdrop. WALTER was off in some binary netherworld, but had left a place name written boldly across the screen. Each time Tyler looked at it the name came off the screen and hit him in the eyes. In '23 he had done a period piece on the lurid Hollywood murders that had been this particular madman's attempt at fame and the images it had revealed had remained in his memory—bloody words running wetly down an expensively decorated wall. Tyler took a long swallow at the gold-chased flask that snuggled so comfortably in the left inside pocket of his jacket. The hot flush of the spirits flowing his gut calmed him. The name was just a coincidence. Nothing more.

3

The van thudded roughly over an eroded expansion seam in the archaic concrete two-lane, jarring the noteboard off Tyler's lap onto the floor, and he opened his eyes to find Leonard, their driver, staring speculatively at him from the rearview mirror. "Sorry," Leonard said, though his tone was far from apologetic. "Most people stick to the maglevs now. Feds hardly keep the backroads up anymore."

Tyler bent and picked up the fallen noteboard. The screen brightened as he touched it and WALTER reappeared, his digital features wrinkled up in an expression of annoyed concern. "Got that hook yet?"

"You're a pain, anybody ever tell you that?"

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"You just did. What's the hook?"

"Tourists from space."

WALTER had no need to breathe, but nonetheless, he sighed. "You're serious, right?"

"It's obvious. Viewers can relate to it."

"Don't mistake boredom for idiocy. UFOs have been milked to death as tabloid filler. You've got a gang of scared overage ex-Yuppies out there looking for salvation from failed dreams; so even if the ovoids are no more than experimental Soviet space probes wandering free, you've got to make them appear to be something more; something that just might prop this over-populated and crumbling world up and make it work again. Get 'em happy and MacKenzie will *have* to put you back in your anchor chair."

"Hey, I believe, brother." Tyler laid his hands mockingly on the note board. "So WALTER, why is it you have such a knack of making me feel like a puppy that has wet the forbidden carpet?"

The noteboard didn't answer at once. Instead a gas probe snaked from the case and whined as it sucked in a snippet of air. "You drink too damn much." WALTER assumed a reproving expression as he stared up at Tyler from the screen.

"You found me out. I've got this seriously deficient store of oblivion in my system." Tyler smeared a finger across the dirty glass of the window, making a greasy streak that glowed sunset-orange. Behind the streak wooded hills merged with the dark shoulder of sky. There were demons out there. Now that the length of Hokkaido had been transformed into an oyster farm and the world bank was demanding interest rates in triple digits, everybody was scrambling, not just ratings-desperate news hounds. It was no wonder the consuming masses on the other side of the glass had grown hair triggers on their channel zappers, displaying a tendancy to make a commercial disappear microseconds before the goof in the actor suit could begin to emote on how sore his butt felt, or how his dentures were always falling out in the soup.

"You want something special you'd better give me more on this story you're building for me."

WALTER made an annoying "tutting" noise. "Not yet. I'm still correlating data."

"I thought you were done with that?"

WALTER's expression wavered between confidence and concern. "Initially I had assumed so. But certain reports began to lead me into others, which branched off into new avenues, and so enlarged the mystery."

"Pretty complex for a bunch of little guys made of swamp gas, huh?"

"Neither guys nor gas, the expected characteristics of life are not present." WALTER hesitated. "Edwin, a warning about your growing flippancy. It's hurting you. During your Hokkaido subsidence broadcasts I witnessed a billion people close to tears. Despite being up against the collective attention span of a three-year-old, you made them care. Don't waste that gift."

"Is that why we're in Iowa chasing phantom fireflies, so I won't waste my gifts? Iowa's your idea, WALTER. I was ready for Old Beirut; the Middle East has always been ratings dynamite. What do you think has kept "Nightline"

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alive for nearly fifty years? All that's out here are flipping trees."

The image on the board raised nonexistant hands to imaginary heavens. "Granted, inhuman carnage perpetrated in the name of a horrified God was always on tap where your religions found their birth, but the factions worth displaying for civilized censure are economically faded, starved into quiet. Desperate mullahs posture for ever more reluctant and stingy loans from the wealthy fearful, but blackmail only works on the timid, and the Arab nations are maturing into responsibility. Such a trip now would have been wasted. You require something extraordinary, a story of memorable and magnificent proportions, a foil to grab attention away from a host of other problems. Something like your California Promise. Remember?"

Tyler allowed himself a small smile of remembrance. "I was in college then. It was a pretty dumb stunt." On impulse, Tyler reached down and shut off the board. Depriving WALTER of electricity was sometimes his last defense.

The California Promise thing had been born out of too many beers and bored creativity running loose, hatched out like a bright spider. Finding the participants hadn't been difficult, but convincing warring core city "tribes" to follow a common direction had been, well, "interesting." Tyler grinned and closed his eyes, remembering long ago.

"Look, man, you could be dead if I don't like what I hear." The street kid was probably no more than twelve, but his face was as hard as old steel left too long out in the elements. His friends were even younger, but there was a coldness in their eyes that said they had jumped from youth directly into a world that had no use for them.

"You'd be killing a good deal. There's easy money in it."

The hostility shifted to speculation. "So, you got money." The three in the alley got more twitchy, chewing at thin lips like razors. Colors were important in their lives: blues, browns, yellows, even multiples of hues, and this wild-eyed Red had a runny nose stuffed full of chemicals. The greasy bandanna around his head and the pack of brown Mexican cigarettes rolled up inside one sleeve of a red-checked tee looked like props from an old James Dean movie. He stared black-eyed and sassy at Tyler. "Some things you do fer money. Some you do fer pride. What you got fer us, man?"

"See this?" The photo was faked, but those three wouldn't know that. Three pairs of dark eyes ran like suspicious mice across the image. "Capistrano's 49th Street territory. Dana Point and Mission Viejo are probably going to the Bloods. But you guys aren't anywhere. And we thought you were tough."

"Sheeet," the kid spat in the dust of the alley. "Paint don't mean nuthin' if you can't hold da land. I told you, we don't play games."

"OK." Tyler grinned, and in those days he had had a good grin, it could piss off a saint if he worked it right, and he most often did. "Forget I said anything. OK?" He grinned again and started for his car the smart way, backwards, the way you walked away from a cage full of tigers.

The hurried consultation between the three sent Red hurrying up to him.

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"Look, man, gas ain't free and these places you're talkin' about aren't exactly next door, gotta take the Nairobi Highway, so it's gonna take some bills to move us: Paint costs. We're arteests."

"Sure. I knew that." Tyler passed over two hundred already packaged in brown paper covers. "And here's a map. Remember, the more decorations you spread around, the better the effect'll be."

Number Three, who had been silent up to now, said, "This is bullshit. Heavy shit's gonna come down on us 'cause of it. And this guy'll get off clean no matter what happens to us."

Tyler kept two fingers on the bills. "Yeah, it's risky, you might get stopped by a patrol. Nobody's forcing you, so if you'd rather not?"

Red threw a nervous glance up the street. "Hush that crap, Mustapha," Then to Tyler, "You just check out the news tomorrow. Gonna see some nervous fats, man. South county's going to be squirmin'."

That night came and went in the quiet streets like magic, trailing cryptic symbols across pristine stucco walls from El Toro to San Clemente. Angry marks, statements of turf, large threats and big boasts. Yuppieland wore the stripes of gang turf like an uncomfortable tattoo gotten during a drunk, a tattoo that it frantically attempted to erase the next day only to discover that, like life, no matter how heavily the marks were over-painted, traces of things gone before always remained. The real world had briefly intruded on a fragile perfection and had made the dream a little less real. That same night Tyler had found his style: shock 'em, wake 'em up and make 'em see the world! It was a way to make the citizens live, even if vicariously.

"Hey, man," The driver's mellow baritone stirred Tyler from his guilty doze. "Prime that camera unit and point your face out the window. We've got a peeper."

Tyler glanced out the near window and started in surprise. Beyond was a gilt sphere, six glassy lenses staring in through the dirty glass, hanging motionless just outside the van window. It made no visible movement apart from simply being there, which was in itself an impressive act, considering that the van was doing nearly sixty on a curving road that periodically dipped through shallow gullies. Tyler fumbled for the broadcast unit, located under a pile of soft luggage, and yanked it free. "What's it been doing?" He shouted as he brought up the unit and found himself under the ovoid's unwavering gaze.

"Being curious, man," Leonard's hands danced with the wheel in the darkness. The van was accelerating, swaying down the dark road like a thing berserk. It vaulted a rise and the front tires squeaked like a jetliner touching down as the van met the road again.

"For God's sake, slow down before you kill us," Tyler activated the unit and blinked as high intensity halogen lamps blazed out into the night. The knife-edged reflections off the polished skin of the ovoid hurt and he struggled to stop them. Apparently the metal ball found the lamps equally annoying. An explosion of scarlet light turned the black night to an aurora of pain. Tyler

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panned blindly, pawing at his swimming eyes.

"Hey!" You trying to put my face out, man?" Leonard protested from the front seat.

The glimmering ball had vanished as if into thin air. Shaking slightly, Tyler put away the broadcast unit and powered up WALTER. But the AI only nodded sagely and said: "See, I told you. There's a mystery here. Better find out what it is before we put you on the air."

Silently Tyler nodded agreement.

4

It had been dark several hours when the sky began to show an ugly rainbow of light; a motel zone, a blight that surrounded small towns like rings of resistant-free-economy bacteria, waxing healthy on the outskirts of planned growth. Red, green, and blue pulsations bounced from low hanging clouds as if a battle was being waged full force up ahead. Leonard glanced back at Tyler questioningly. "We stopping?"

WALTER answered for him, "Drive on about five miles. The sign'll say Manson."

"You always let that box make your decisions for you? Just what the hell is a WALTER?"

Tyler frowned at the interruption, he had just had an idea for the hook. "A WALlings-TElecom-Remote ratings and research analyst that lets me know what's airable. The multimedia interface's been programmed to emulate one of the great newscasters of the sixties. Like it says, we're going to Manson, so turn at the sign."

"Sure, sure." Leonard, silhouetted massive and dark against the windshield, glanced first at his watch, then longingly at the lights ahead. "Be close to midnight when we arrive." The driver's wistful expression suggested that he had been looking forward to a hot dinner, a hotter shower, and a soft bed, not a badly sprung seat in a cold van and a dose of morning stiffness. "It's just that it's gettin' tired out, man."

"Look, *man*, you wanted a good night's sleep you should have gone to work for a mattress company. Spencer's not paying you enough?" Tyler regretted the words almost as they had left his mouth. He sighed. "Look, we're all tired. But we've got to be somewhere. It's important."

"No problem," Leonard hammered the van into gear. Stressed tires sang dual songs of discontent as the vehicle squealed itself off the sandy shoulder and back onto tarmac, accelerating them beyond the light and confusion of the motel zone, sliding into darkness. Seen through the windshield, the road was a black ribbon of ink cutting through a moon-gray murk of wooded hills. The farms had stopped, there was no light except for the sliver of the moon and fleeting patches of stars, and not so much as a traffic signal beyond.

Tyler prodded the noteboard. "I need info, WALTER. Talk to me."

"The patterns are a little puzzling. It's evident these visitations have happened before, during World War II pilots called the ovoids *Foo Fighters*. In the Fifties they were saucers. From the sixties through 2030 it's been fairly quiet, but there's other evidence even more ancient."

A huge white moth splattered its life

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out against the windshield with a soft *splut*, and Tyler shivered. "What do you mean?"

WALTER's screen showed a pale limestone wall with figures painted delicately across it. "This piece dates from the Neolithic of France . . . the woolly rhinoceros shown is of course extinct. The hunters in this cave carving could be worshipping the tiny round thing floating there above the rhino, or they might be fleeing from it. Authorities willing to go on record differ as to interpretation."

"Come on, how could a civilization last that long?" Suddenly the flask buried in his jacket seemed very heavy. It tugged at him, asking to be picked up, and Tyler had to fight hard against the temptation to grab at it. "WALTER, this is starting to sound like Enquirer crap. Are you setting me up?"

"You wound me, Edwin. I will provide the details once I have fully explored these many loose ends."

"The hell you say! Look, I can't introduce and describe something I don't understand."

"Relax," WALTER chided gently. "A good anchorman composes on the fly. Sometimes you just have to *be* the story."

"Good. Great. Alternately, I suppose, a good anchorman wouldn't have to go to Manson, Iowa to find a—"

"I didn't want to bring that up," WALTER paused. "Wait, please. The network data controller has begun modeming additional information into storage and I don't want to overload my processor."

"Sure, sure," Tyler looked out into the night and pictured sagging computer housings melting in a hellish glow. But he didn't picture it long for just then Leonard shouted and crammed both feet onto the brakes. The van, surprised metal with primitive reactions, locked all four wheels and skidded sideways, shuddering to an ice-in-the-guts, looping stop that almost put them in the bushes alongside the road. The noteboard went flying as Tyler was thrown forward into the aisle.

"Damn it, Leonard," Tyler yelled, "Give a guy some warning."

"Bitch at me later, man. Get yer camera. Look at that out there."

Tyler looked, and looked some more, then sucked in his breath. The roadbed was dotted with clusters of gold-colored ball-like shapes milling about like frantic pillbugs in the crazily canted twin beams of the headlights. Tyler had a wild thought about mating season in the gold vaults at Fort Knox, Kentucky and choked back a laugh.

"Pick me up." WALTER ordered from under a seat. "Show me what's out there."

"Big crazy gold ball-bearings like fish spawning on a beach." Tyler swung the noteboard around at the windshield. "Start talking. What the hell are they doing out there?"

Leonard's baritone boomed, "Like maybe it's a remote spot for intergalactic news? The shiny one there on the end with the dent, he's the producer/director. That one over there is the camera/sound man. That dumb pretty-looking one, well he's the . . ."

Tyler didn't want to know who Leonard thought the dumb one resembled. He took out the flask with grim determination and killed it, clipped the note-

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board to his belt, then grabbed the broadcast unit. Info on not, he was going on. "Leonard, I'm rolling as soon as I'm on the pavement. They'll have to chop excess dialog and footage back in the studio. Key the uplink and warn Schuuts back at network that he's got a transmission coming in."

"Look," Leonard warned. "Heard those things killed a guy up near Omaha. Least nobody ever found a body."

"Come on, this is Iowa, not some Third-World venue." Tyler hesitated with his hand on the door handle. "But keep the van running. You hear?"

"Got it." Leonard's black eyes followed Tyler out onto the asphalt where the golden things dotting the road reacted to the newscaster's arrival by orienting lens-pocked fronts toward him. One was hanging up in midair, as if posing as the captain of this outworldly team. "Luck, fella," Leonard murmured. "You may be an asshole, but you got some meat hangin' on you going out there in the black of *this* night."

5

Tyler activated the broadcast unit on the run and the saucer-shaped dish of the camera unit vibrated and lifted from his hands, suspending itself, and swiveling around to point at his face. Following a focus spot that Tyler could throw with a small UV laser, the unit's pickups could pivot around to cover whatever happened. Tyler spun on his heel and, summoning an expression Columbus might have worn upon stepping from his ship's whale boat and finding the New World stuck to his boots, assumed his pose, chin up, hands carefully out of sight, grinning like the guy next door with some juicy gossip to relate. "Rolling."

"Remember to look humble. That's your public out there," WALTER admonished. Tyler blinked, distracted. Then, in a flash of inspiration, dropped to a knee next to the nearest of the ovoids. Video and audio data was already streaming from the van's antenna. Flooding across America and parts of Europe, even Australia, a *SPECIAL ANNOUNCEMENT* header would be appearing on billions of home broadcast units, breaking into countless sitcoms.

"This is Edwin Tyler, your man on the spot. Folks, for years the possibility of extraterrestrial life has been denied by top scientists," a carefully planned key phrase, since demographics had shown a continuing distrust of the honesty of institutionalized science among the working masses. Tyler gazed at the ovoid-dotted ground and smiled widely. "Well, despite that, it seems to be tourist season here in Manson, Iowa. The word of the dollar's fall—maybe we should call it a plummet—seems to have reached even Beta Sirius and beyond, and the tour packets are pouring in, spreading out all over this Earth. Tonight we've caught them soaking up the rural culture of mainstream America, perhaps about to take a load of Earth's antiques back to the folks at home and give our whopping trade deficit a little relief." He paused to launch another smile, this one into the lenses of the broadcast unit, letting the audience catch up and enjoy the humor. He was in the groove tonight. Even WALTER was grinning. Yeah, Edwin Tyler was back! "Seriously, this arrival is as momentuous an event as has ever happened

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here on our Earth, an event with the significance of . . ."

As Tyler sorted through his catalogue of "safe" momentous events, seeking a reference that would not offend any of a million religious, political, and social groups, the crawly-balls began to react to the lights glaring on either side of the broadcast unit, ballooning up around Tyler, a behavior he privately rejoiced at because it made a super shot being surrounded by these gilded balls. Not even WALTER could have planned it more effectively. Even better, the star of the group seemed to be coming right at him at waist level. Tyler was just easing into a mild speculation about whether or not the ovoids were aliens when the ovoid pushed itself into him hard, like a big dog nuzzling. Tyler grunted. He grinned and mugged for the camera. "Hey, I was here first. . . ."

The night flared white.

Tyler blinked tears from his eyes, painfully aware that his ears were chiming like St. Pat's cathedral at a morning mass. The darkness had momentarily been transformed into a supernova brightness that only now was beginning to sag and melt away as his vision returned to normal.

"Ah . . . something's happening here," It was weak as continuity went, but he was hurting. Tyler peeked through split fingers, cursing under his breath, knowing that if he lost the moment the network would immediately cut to a commercial. "WALTER," he hissed *sotto voce*, "what the hell happened?"

"I believe we've lost Iowa." WALTER's voice was deadly calm and Tyler started to sweat. *Where the hell was that flask?*

* * *

6

Tatters of normality reached into the anguished white-hot cotton that had packed Tyler's blinded optics, but the bleached images his overstimulated retinas were providing him didn't make sense. The cool Iowa night and pale sliver of new moon had been replaced by a wild-looking cypress forest scorching under a blazing sun. The mobile news van with its rod and spiral of uplink antenna had been replaced by a large boulder. A garishly colored reptile squatted atop it, flipping its forked tongue out at a gamey breeze—hell, that was putting it delicately. There had to be a dead whale poaching just behind the trees. From those same trees something hooted and the forest that curtained the horizon with a dark green wall answered with a thunderous refrain of honks and trills.

"WALTER, we still transmitting?" Tyler hazarded, careful not to show the panic crowding his equilibrium. If this *was* a hallucination, he'd better keep it to himself. Getting unhinged on the air meant a quick ticket to the retired newscasters home.

"WALTER?"

There was no answer from the noteboard, but several vigorous hoots issued from the distant trees.

"Hey, come on. I'm alone here. Well, no, not really alone, there's this goofy dance floor glitter ball hanging in midair above me." The alien "whatever it was" had oriented its glassy lenses skyward, ignoring Tyler completely. "Talk to me, buddy."

"It's OK. I was scanning." WALTER was frowning as he played with

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imaginary data switches in his background. "By the way, we've lost the link, so you can stop looking so casually in control."

"Damn!" Tyler spun around to aim a kick at the broadcast unit and took a header on his backside because it wasn't there anymore. As he lay there it came to him. MacKenzie! The perfect little shit had targeted him for revenge! This whole thing had been a practical joke!

WALTER was busy checking out the electromagnetic spectrum "Odd, the transmissions are continuing, it's a very odd waveform.

"I just bet they are. WALTER, don't you see the FX gang's touch in this? Just what did they bribe you with? A real body?" Tyler struggled to his feet. "Good joke, guys." MacKenzie must have planned one last indignation for his failing anchor. Rub his face in his disgrace, then write him a contract for Last Outpost Idaho doing weather, or, perish the thought, sports. "It's elaborate, guys. I like it. All these prehistoric plants must have cost you a bundle. And the ovoids are really a great touch; I wouldn't have bought off on the bit without them. Who'd you get to design them? Imagineering? ILM?"

The thing in the lizard suit lolling atop the stone rolled massive lids down over its bug-eyes and went to sleep.

"Now that could have been better. The lizard thing should have bit me. OK, guys. Hit me with the punchline." Tyler spread his arms out in a sacrificial gesture. "I can take it."

Nothing happened. The sun continued its searing presence across the brilliant sky, the forest shimmered in the heat, and a chorus of insect life proclaimed that all was normal. When the laughing crush of knowing staff members did not materialize on what had to be an elaborately decorated sound stage, Tyler began to get annoyed. He seized a large stone and pegged it at the hovering ovoid, which moved aside easily and went back to attempting to blind itself with the sun.

Twenty feet away an armored reptile, the size of a one-man commuter shuttle, heaved itself into view, making the glossy, knifelike leaves of a large cycad rustle like broken glass. A nearby bush shivered in response.

"OK, clown, got ya. No more fall guy." Tyler headed for the disturbance. "What'd you knock me out with? A fistful of Blues in my booze? I'm gonna mess you up, man!" He dug his hands deep into the branches, felt something warm that struggled, and yanked it out.

Red-orange wattles and eyes the size of Florida oranges glared at Tyler above a mouthful of chunky teeth that flashed like bloody ivory in the sunlight, as the creature tried to take his face off with a single swipe of its jaws. The creature yelled, really hooted, and took off like a bowlegged track star as Tyler lost his grip and collapsed face first into a patch of bristly ferns.

"Tyler." The tone of WALTER's voice suggested that what was going to follow was good advice. "I'm advising relocating to a more protected position."

Tyler peered around and didn't see anything he considered protected. "Oh?"

"There's a substantial outcropping of granite not fifty meters away. Choose that."

The stack of rocks in question looked

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like a hard climb, but another series of deafening hoots from the forest provided motivation. The vigorous climb to the summit of the outcropping had one side effect, it got him to thinking. "WALTER, you in on this?"

"*This* being?"

"This stunt. I know there're some companies making some really great robotic models, but that thing I played choke-the-chicken with was pushing robotics technology to the limit."

"As far as I can tell, the creature you wrestled was alive, closely resembling a juvenile male hadrosaur sporting mating coloration, judging from paleosociobiological papers on file in my memory and the current fashions among male lizards."

"A Had-what?"

"It's extinct. For over sixty-five million years. A fossil record for that time period in this area is nonexistent, but a fragmentary specimen of hadrosaur was discovered in Cretaceous deposits of the Eastern US. I'm guessing we might see various specialized examples of iguanodontids, some late Cretaceous examples of sauropods similar to Cetiosauricus or Ornithopsis, and various predatory megalosaurids and dromaeosaurids."

"Well that's just great." Just then a vast shape soared majestically overhead, a fur-covered ultralite of bone and flesh, with a face like a missile. Tyler knew right away that it was a pteranodon because a model regularly flew over Central Park in the summer as part of the Natural History Museum's paleontology exhibit. Of course the colors on this one were all wrong. Pteranodons were brown and this one was snow white with contrasting black and scarlet slashes decorating the sides of its triangular face. The creature regarded Tyler with one huge eye, then wobbled on over an arm of forest. It seemed to be troubled by the lack of wind. The air, though hot, was strangely still, and there was an eerie tingle against his skin. It felt like his hair was standing on end. The sky was turning an eery purple shade that presaged a violent thunderstorm, but no clouds were in sight. Tyler looked for the ovoid and found it hovering pretty much where it had been before, lenses still staring fixedly up.

"What'd that gold-plated phony do to us, WALTER?"

"Data are still being processed. But based on a distribution of sightings I now have access to, there seem to be regular intervals of visitations peaking during times of stress: major wars, plagues, famines, natural calamities. What is unusual is the great durability of the design of these ovoids. Meaning . . ." WALTER hesitated.

"Meaning what?"

"It's quite possible that if these . . . ah, ovoids can travel temporally as well as spatially, suggesting that they could sample all of our history in a single instant . . . that instant being in their frame of reference, of course."

"Of course. Meaning?"

"The ovoids are utilizing a single visitation to document the entire history of our planet."

"That's impossible, WALTER." A cold tendril of sweat trickled off Tyler's neck and raced down his spine. He took a deep breath and let it out very slow. It wouldn't take much to send him shrieking off this rock and down into

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the forest, probably to end up as dinner for some stilt-legged monster with no more wits than a blow-dryer.

"Perhaps. There are other realities to consider, more pressing than the ovoids and their reason for being. At least the climate here is not unlivable." WALTER stated this last with an encouraging lilt to his voice.

"Damn livable, providing you like Louisiana." Tyler watched something like a tank-sized biped waddle through the clearing and pause to maul a thornbush into splinters with a flattened mouth like a gravel mill. "And no shortage of interesting neighbors, it's great." He looked up, realized the ovoid was ignoring the wildlife. Stupid thing. Chance of a lifetime and it was blowing it. "Hey, you up there. How about an interview? Feel chatty?"

The only reaction was a small lens on the gleaming face that swiveled over briefly. "Guess not." Tyler took out the flask and found it empty. Cursing, he sailed it out across the clearing and watched it bounce in front of the creature WALTER had called a hadrosaur. In a stand of nearby forest several long-necked creatures were browsing the tree tops. He interrogated WALTER about it. The alamosaurs—cousins of the Jurassic brontosaurs did survive into the Cretaceous, at least in the fossil record of Utah. Perhaps these were "East Coast" relatives. Then again, maybe he was starting to see things that weren't there "OK, Tyler my man. Before you panic and go off your gourd, pick your options. Any future for a broadcast anchor here? Not hardly. No TV, no technology. Just WALTER. Won't even be any cave girls to play with for forty or fifty million years, even if you liked hairy armpits and natural musk, so I expect you're going to be one horny sucker come the Pleistocene." He chuckled, momentarily picturing himself as a yuppie caveman.

"Something amusing?" WALTER inquired.

"Yeah. Maybe things work as long as you don't take life too seriously, don't make too many plans, just kinda skim along. But start thinking you're some kinda pinnacle of evolution and BANG, banana-peel time."

"Laughter *is* good therapy," WALTER agreed after a moment's consideration.

"Sure it is. What's the odds of getting out of here?"

WALTER pursed nonexistent lips. "Perhaps you should take stock of your resources."

"Don't like the sound of that." Emptying his pockets Tyler spread out their contents: lighter, loose change, faux leather wallet, slimline appointment computer, not exactly a world conqueror's pick of favorite items to be trapped in the past with. Tyler flipped open the wallet: photos of a daughter from an early marriage, a paper twenty, well-wrinkled, and enough plastic to choke a carnosaur.

The ovoid began to hum loudly, orienting itself in a new spin angle.

"Curious," WALTER said thoughtfully. "The device has begun to transmit signals directed toward the ionosphere."

"Transmitting? But if the ovoid is transmitting, it must be doing it for someone, something is receiving those transmissions, if so that means . . . WALTER, could that thing be our ticket

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back to microwave appliances and automated tellers? No news crew leaves expensive cameras behind after a shoot, and that's just what that thing is, some sort of high-tech camera, sound guy-director-commentator, the works, all rolled up in a shiny metal ball. If it got us here, it can take us back. Tell me about those people who disappeared."

WALTER stroked a digitally generated chin as he prowled databases at lightspeed. "Each missing person was in close proximity to an ovoid that vanished, just as you were."

"Sure they were. The energies generated during transport must produce an eddy effect." Scrambling down from the rocks, pausing only long enough to grab a fistful of credit cards and jam them deep into a crack in the rock wall, Tyler descended the cliff in a shower of dust and thudding stones. "Environmentalists whine about how plastic doesn't break down. Well, I wish I could be there when some paleontologist chips these platinum gems from the strata of sixty-five million years ago. The expiration dates ought to drive him crazy, if they're still readable."

Tyler dropped to the ground and made a dash for the gleaming ball spinning overhead.

"I advise utmost caution." WALTER warned. "Due to strong field buildups."

"I'm advising extreme patience. That's our doorway home creaking open. Trust me."

The ovoid was flickering, surrounded by the pulsating pinkish glow of a plasma field. Once there had been old shows on flat TV where this character named Scotty would beam people all over space. It was beam-up time. He sprang, grabbing at the gleaming polish of the ovoid so dark against the strange glow building overhead. The sky looked like the granddaddy of all thunderstorms was about to break. Out in the forest things were getting spooked, rust-brown dinosaur-giraffes, with necks you could strap a sail to, were rearing up among the pines, staring stupidly upwards, not really smart enough to know they were in deep Bandini, but their spinal ganglia possessed enough ancient "horse-sense" to feel the change in the air and be scared. Maybe this had happened before.

Tyler grabbed frantically, but his fingers just slipped off the slick surface of the ovoid and he fell. A distant grumble of thunder shook the hills the way a dog would shake a rag toy as Tyler hit the ground and his breath left him with a *Whufft*. "Friggin' freaky weather," he panted. "Damn it, WALTER, give me the benefit of all that data you've been assimilating. What's going on? You know, don't you?"

"I know *now*. We are at the outskirts of Manson, Iowa."

"Well that's a flipping hot flash."

"I am very ashamed. I neglected to access ancient history, in particularly that of this area of Iowa 65.3 million years ago."

"Certainly clears it up for me," Tyler gasped, tensing to leap again in another attempt to seize the hovering ovoid.

"This is serious, Tyler. A small asteroid has entered the atmosphere and is descending at a steep angle. The compression front is hammering down even now, about to blast a crater several miles in diameter. When the asteroid

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nears the ground it will throw out the puddled molten rock pooled below it as white-hot gas. A fan of fire will ignite forests all across this land mass and the Western highlands, sending a shock wave like that of a nuclear blast across the mid-continental sea that divides them. The massive input of steam and ash will cause climactic disturbances that will endure a thousand years, killing all major forms of life in this time."

Tyler paused in mid-spring. "Iowa? The end of the world is in Iowa?"

"Yes. The evidence, a crater hidden deep under the ground, was not discovered until 1989, having been filled in during the Ice Ages, but the shocked strata was detectable with seismic equipment. I just didn't think to look this far back. I'm sorry, Tyler."

"Sorry? How can you be sorry? You love this shit. Science always was your angle when you were on CBS, so forgive me for not hanging around to be fossilized. This is one spot I don't intend to be when—"

"I'd doubt there will be much left of us to fossilize." WALTER, always primly accurate, inserted into the introductory moment of quiet that prefaced the end.

Tyler, tense and trembling, didn't hear as he thrust himself up, giving it every last bit of his strength and determination, reaching wildly above for the shimmering metal ball. Reaching, reaching, shouting as he felt his fingers touch hot metal. "Got you," he howled triumphantly just as the ovoid pulsed. An instant later a flash-blinded Tyler screamed as the Cretaceous Terminal Event seared his stash of planted credit cards, and a million-plus stampeding individuals of dinosaurian life into superheated atomic vapor just slightly cooler than the surface of the sun. He never heard the quiet chuckling of thunder rolling across a vast and godlike sky, never witnessed the long sad years of desolation or saw the first timorous explorations of the survivors into a new age.

EPILOGUE

Tyler landed with a thud on hard gravel, it hurt. His burned hands were throbbing. He took a breath and was immediately afflicted with great racking coughs. Stinging dust puffed up into a talclike cloud and made the thin, dry air even less palatable to his laboring lungs.

"Put your hands over your nose," WALTER admonished urgently.

It helped, but even so each breath was like the chill jab of a knife into his chest.

"And I thought New York air was bad." Tyler put his seared hands under his armpits, to protect them, and looked around. "Where is this?"

A pallid sun, rotten with sunspots, hung bloated over a bleak desert landscape, its weak rays glancing blindingly off an immense golden *thing* floating with airy grace over the stony wasteland . . . a metal mountain made of knives. A fleeting gilded speck was speeding toward it.

Tyler grimaced. "Our escort, going home no doubt. Should never have let you take me to a place named Manson . . . had to be a killer with a name like that . . . never felt sorry for dinosaurs before . . . just figured them for big, dumb, ugly brutes . . . misjudged them . . . shit, look at us, and we're

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supposed to be smart . . . this is our last stunt, WALTER."

WALTER was studying his sensors. "Perhaps. Perhaps not. Look there."

Several bright specks were speeding rapidly toward them from the direction of the ship. "We have visitors."

Despite the bad air, Tyler began to laugh. "Now we're in for it," he wheezed. "Here come the reporters."

WALTER didn't respond right away. Tyler didn't notice, he was slowly turning blue.

"If they are indeed intergalactic newsgathers, perhaps they will need an anchorman," WALTER said brightly.

Still coughing, Tyler reached out with his foot and kicked the noteboard—hard. ■

IN TIMES TO COME

● Next month marks the 61st anniversary of *Astounding/Analog*, so we'll be commemorating the occasion with one of our twice-yearly "double" issues. All that extra space lets us do things that we couldn't in a regular issue, such as running a full-length novel in its entirety. The one we proudly offer in our January 1991 issue should be an especially fitting treat for *Analog* readers.

Orson Scott Card launched his career here in 1977 with "Ender's Game," a novelette which immediately attracted widespread acclaim, later grew to an award-winning novel, and has generated an entire historic universe. It seems particularly appropriate that *Analog* should also give readers their first look at *Gloriously Bright*, one of the last stories to be set in that universe. You'll feel the strangeness of the culture Card has created right away; I doubt that you'll be so quick to guess the sinister reasons for it.

Even with the novel, we'll have room for an uncommonly generous and varied selection of shorter fiction, including one of the novelettes John Barnes hinted at in his March 1990 "How to Build a Future" article, plus stories by many other favorite *Analog* writers as diverse as Joseph H. Delaney, Amy Bechtel, Michael F. Flynn, Maya Kaathryn Bohnoff, and Rick Shelley. Martyn J. Fogg provides the fact article, on "Once and Future Mars."

A reminder also of one event coming up here: we'll soon be counting the Analytical Laboratory votes for 1990. Please be sure to get yours in before February 1.

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W. R. Thompson

LOST IN TRANSLATION

A little something for those who think translation is a simple business. . . .

Todd Cameron Hamilton

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"Why science fiction?" Ray Bennet asked. "I could understand if you wanted literature, or poetry, or even whatever passes for nurse novels on Kya, but, my God, why *science fiction?*" Ray had once suffered through a college course on the topic—Classic Literature of Late-Middle-Twentieth Century America—and the mere thought of SF still made him shudder.

"There's an excellent reason," Samuel Keating said. The publisher put a hand on the manila folder atop his ornate desk: "I have the market research right here. It proves there's a market on Earth for kya sci-fi. People want variety."

"And you want to cash in on this," Ray said. Cash, indeed, he thought, glancing around the office. Even among university linguists Keating Press was known for its astute marketing practices, and the success of those practices showed in the elegant office furnishings.

Keating smiled, showing sharp teeth. "Correct, Doctor. We want to cash in. Cash is what publishing is about. We need a translator, and you're an authority on kya language."

"I'm one of many experts," Ray said.

"You're also one who has translated several Russian and Chinese novels into English. Your works are good and readable, which is important. Clumsy translations don't sell."

"No, they don't," Ray said, reflecting that excellent ones did little better. If they did he might not have been in this position.

"I'm offering a simple deal," Keating continued. "You'll translate one kya novel into English. You'll work on Kya. I'll pay all your expenses, and you'll have six months to complete your work—"

"Six months?" Ray was surprised. "I won't need that long."

Again, the sharp-toothed smile. "Perhaps, but I won't count on it. I'm giving you enough time to do a smooth, elegant, *salable* translation. One that doesn't need footnotes or appendices. One that doesn't contain bizarre, unexplained kya attitudes that will leave the readers scratching their heads. I want all alien concepts explained in terms that people can understand."

"I understand." Ray suppressed a smile. The kya were the evolutionary descendants of plains-dwelling herd creatures, but he felt that their "alien" qualities were more a matter of perspectives than fundamental differences. Ray could spend a few weeks translating a book, then devote the rest of his time to studying kya languages first-hand. Six months on Kya!

Delighted or not, Ray had questions. "Why send me to Kya? I could do the translation on Earth."

"You could," Keating said, "but the author, a fellow named Gyez, insists on working directly with the translator. As I was going to say, you'll translate his book *Roam to Infinity*. It's a best-seller on Kya and it has a human character, which is why I'm interested."

"You want to hook people with the kya view of humanity." Ray said. He felt a certain admiration for Keating; that *was* an intriguing notion, and one that would appeal to human vanity. It

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might even improve human-kya relations if people could see themselves through kya eyes. Several incidents had strained relations between the two races, and anything which helped eased tensions was welcome.

It's warmer than I expected, Ray thought as he walked down the lander ramp. He had braced himself for cold air, fog, chilly breezes; he found himself in the middle of a balmy, sunny day. Ray took off his coat and draped it over his suitcase, which beeped indignantly as the coat obscured its sensors. With a sigh Ray took the coat back. Mollified, the suitcase followed Ray down the ramp and onto the concrete landing patch.

Ray looked around. Aside from the lander and its human crew, now busily unloading its cargo, the scene was . . . quaint, he decided, like something from a century ago, say about 1930 or 1940. The lander had set down in a corner of an airport, a place where propellers buzzed on winged machines and vast lengths of concrete allowed them to climb into the air. Obsolete on Earth, such things were an integral part of Kya's global economy.

"Doctor Bennet?" Ray looked and saw a man standing behind him. The man was middle-aged, tall and heavy-set, and spoke with a Swedish accent. "Olaf Nyquist," the man said. "I'm the UN ambassador. I'm here to help you settle in. This way, if you would."

Bemused, Ray followed Nyquist. "Do you greet everyone who comes here?" he asked. "That seems like a full-time job."

"We don't have that many visitors yet," Nyquist said. "But even if we did, it's still an important part of my duties. You see, there's an isolationist faction here."

"Are they a problem?"

"No," Nyquist said. "They're not aggressive, but they *are* waiting for humans to do something which they can exploit. That's why I like to greet, and brief, all newcomers personally."

"Oh." Ray looked around. They were walking towards a limousine, away from the airport buildings. "Don't I have to go through customs?" he asked.

"No, the kya no longer require that." Nyquist opened the car's trunk and the suitcase climbed in. "They trust us to prevent the importation of contraband."

"That must make things easier," Ray said as they got into the car.

"Go to Gyez's home, James," Nyquist told the car. He looked to Ray as the repulsors lifted the car. "No, Dr. Bennet, it makes nothing easier. It forces *us* to be assiduous in enforcing their import laws. Fortunately the laws are not too restrictive, but the UN is concerned over the possibility of an incident should any contraband slip past us."

"So you'll search my luggage?" Ray asked.

"No," Nyquist said. "That was done aboard your ship, by experts. My job is to prevent trouble, to make certain that you know the dos and don'ts of life on Kya. This is especially important as you'll be living in Gyez's home."

"I'm looking forward to that." Ray smiled. "And I know what to expect. I've worked with kya before."

"Ah?"

"I learned Wideplain while I studied

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at Stanford," Ray said. "We needed an interpreter for some guests, and learning one of their languages complemented my studies. Naturally I had to learn some protocol to work as an interpreter, and learning the language taught me something about their society."

"Excellent," Nyquist said. He gazed out the window as the car drove into a residential district, where small brick and wood dwellings lined dirt roads. A cluster of children tugged a sandbag down the middle of the street; the car slowed to avoid them. "We haven't had any major problems with the kya since the Crisis, and the UN would like to keep it that way."

"So would I," Ray said. "I don't expect any problems."

"Of course not, Dr. Bennet." Nyquist sighed and pointed out the window. "But do you see what those children are doing?"

"They're playing bagdrag," Ray said.

"They are *not* playing bagdrag," Nyquist said. "Not the multiple-team version, where somebody wins and somebody loses. In the version they play there is no losing. The object is for the team to pull the bag as far and quickly as possible over a convoluted path. They have to be taught to play the game to defeat others. They *do* learn competition, and they learn quite well, but the basics of teamwork, of group feeling, are deeper with them than with us."

Ray felt amused. "You're reminding me that they're not human?"

"I'm telling you of a very real problem," Nyquist said patiently. "The kya are so much like us that it becomes easy to overlook the differences. This becomes easier as time passes—the phrase 'familiarity breeds contempt' comes to mind. In time you *will* find yourself surprised by a kya response to some situation. It's a mistake we've all made, myself included."

The car parked itself in front of a wood-frame house. Ray and Nyquist got out, and as Nyquist opened the trunk a kya came out of the house. "Nyquist! Good to scent you again! Are you Academician Bennet?" The kya bowed and sniffed.

"I am," Ray said, returning the greeting. As he looked at the kya he realized why he had expected cold weather. The kya had thick, short fur, adequate for an ice age; Ray's subconscious had linked fur and cold weather. Ray reminded himself that some of Earth's tropical animals had thick pelts as well. "Are you Gyez?" Ray asked.

"At your service," Gyez said. Along with his brown fur Gyez wore a rumpled cloak and dirty glasses. "Let me help you with your suitcase."

"No need." The suitcase got out of the trunk and rolled over to Ray. Nyquist made his good-byes and drove away, and Ray followed his host to the front door. The building was surrounded by a thick, spiky grass, and the suitcase made slow progress as it crossed the lawn.

The sight fascinated Gyez. "Moving by itself, is it a robot?"

"A simple one," Ray said. "Aside from being self-mobile, it can find me at a luggage checkout stand and call the police if it's stolen. It also turns itself into a small closet, so packing and unpacking isn't a chore."

"Really?" Gyez snuffled in amuse-

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ment. "The first story I ever wrote was about a robot servant. It had a suitcase built into its chest, and—" the snuffles turned into loud snorts "—some readers said it was an extravagant idea, robots obviously being too expensive to use for such a task."

"Robots are cheap." Ray looked around as they entered the house. It was much as he had expected. The front room was furnished with stools, a table, and a bulky radio cabinet. The floor and walls were covered with glazed tiles, and the windows had screens but no glass. Ray understood the logic behind the architecture; the open windows brought in fresh air and the tiles would not retain odors. The kya had an exquisite sense of smell, and that influenced every aspect of their lives—language, architecture, arts.

"Cheap robots," Gyez mused as he took Ray into the spare bedroom. He watched the suitcase stand and unfold itself, becoming a closet as promised. He took a notepad from inside his cloak, jotted something on the pad and put it away. "You must be hungry," he said.

"Yes, a little." Ray followed Gyez into the kitchen, where a stack of cardboard boxes teetered next to an electric stove. Ray opened the top carton and took out a dinner tray. He pressed the heater tab and sat down with the tray, and as he pulled off the foil cover he saw Gyez scribble another note.

Apparently Gyez understood that raised eyebrows signified curiosity. "Background material," the writer explained. "Some day I'll write a scene where a human is eating a meal. Verisimilitude being important, I'm always looking for such details."

"I see." Ray put the tray on the table and pulled up a stool. It was a bit high for human use, and the seat tilted at an angle to accommodate the kya posterior. Ray decided that for now he could eat standing up. "I'll have to get a regular chair someplace," he said, and took a mouthful of corn.

"A chair," Gyez said. "I *knew* I forgot something. My apologies for that detail. Details being mentioned, you were spacesick before you landed, weren't you?"

Ray stopped with a forkful of corn poised halfway to his mouth. "Uh, yes."

"I thought your odor meant that," Gyez said. "It's an odd thing, motion sickness. We don't have it."

"Lucky you."

"Not luck, evolution. My ancestors didn't evolve in trees, so they didn't come up with a delicate, touchy balance-sense." Gyez sniffed thoughtfully. "Evolution being progressive, one wonders why you have motion sickness. Expelling a meal half-digested is wasteful, not to mention messy."

Ray put his fork down forcefully. "Look, Gyez, this isn't the sort of thing we discuss during meals."

Gyez spoke as he jotted something. "Being so, do you have a taboo about, what's that other word, puking?"

"Christ, yes, there's a taboo," Ray said. The mere memory of his last bout of spacesickness produced ominous sensations in his stomach. "Look, let's talk about something else. Work. Have you got a copy of *Roam to Infinity* handy? I'll read it before I—"

Gyez's nostrils fluttered. "You haven't read it?" he asked.

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"No. Keating told me there aren't any copies on Earth."

"What a sneeze!" Gyez said. "What did he tell you about it?"

"Nothing," Ray said. "Keating doesn't know Wideplain, so he hasn't read it. All he knows about the book is that it has a human character."

"A human character. Yes. My, yes." Gyez snorted. "He bought the book without reading it! I could get to like human publishers. But not having read it, he—" Snorting loudly, Gyez walked out of the kitchen.

A sudden uneasiness seized Ray. Somewhere, somehow, Keating and his careful market research had failed. He was certain there would be trouble.

Gyez came back with a book, its front cover made from a thick cloth. There was a crude sketch of a rocket under the title, and as Gyez handed the book to Ray he caught a faint whiff of something oily. "I can't say much for the cover art," Gyez said apologetically. "It doesn't smell anything like a rocket. Artists! Never reading the story, they always say what the belch, a rocket ought to smell like a machine shop. So they mix up some old oil and rust and slop it on the cover."

"Well, I'm not here to translate the cover," Ray said.

"True." Gyez's eyes twinkled behind his dirty glasses. "Enjoy!"

Cold and stiff, Ray sat up on the floor and wished he had exercised a little more foresight. He had known that the kya didn't use sheets or blankets; their fur kept them warm as they slept. Consequently Ray had packed an electric blanket, only to discover that he could not plug it into a kya wall socket. The unpowered blanket had done little against the cool air coming through the glassless window. And the kya didn't use beds. They preferred to curl up—literally—on small, square sleeping pads.

Ray consoled himself with the thought that he couldn't catch a cold on a world which lacked human-compatible viruses. He stood up and stretched, and went into the bathroom.

The toilet was more efficient than its human counterpart, but it was designed to accommodate the kya anatomy as well as to protect the sensitive kya nose. Ray used it, then realized he would have to forego his usual morning shower. There was neither a tub nor a shower in the "bath" room, and he belatedly recalled that the kya disliked wetting their fur. Shaving was impossible, due to the lack of a mirror. With a sigh Ray went to get breakfast.

Roam to Infinity was still on the kitchen table. Ray had read the first three chapters before going to sleep, and the sight of the book made him shudder. Maybe I misunderstood things, he thought hopefully. A lot of the words in the book were not part of the standard Wideplain vocabulary.

Ray eyed the book as he ate breakfast. The story concerned the crew of the starship *Roamer*—its maverick captain, the ship's eccentric inventor and his sweet-scented daughter, and a wisecracking reporter—as they made Kya's first flight into space. By the end of chapter three they had discovered the human colony on a planet of—Tau Ceti, if Ray had the astronomy right. One of the colonists had decided to accompany *Roamer* on its flight to the edge of Galaxy.

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Done with breakfast, Ray picked up the book and resumed reading,

"What a stink!" Gack said as the cabin air filled with a weird aroma. The reporter's muzzle wrinkled. "Do all humans reek so?"

"Get used to it," Captain Vha said stolidly. "Going where we will, we'll whiff far stranger odors."

"Air out that talk about the scent," Research-director Zark whispered, eyeing the alien. "It speaks Wideplain."

"Already!" Gack exclaimed. "How can it learn so fast?"

"I think it has to do with the difficult nature of its own tongue," the scientist told Gack. "Human being such a convoluted language, it must find Wideplain a delight."

"Hideous thing," Gack muttered.

"I think it's cute," Teh asserted prettily.

Seeing the alien, Vha could not agree with her. The human had almost no fur, and its skeletal structure seemed painfully vertical. Its footfingers made tapping noises as it crossed the cabin deck to greet Roamer*'s crew. "I am Climber Pinkskin," it said. Its breath was pure, but its body exuded the disturbing scent of its raw-meat diet.*

Keating is going to kill me, Ray thought.

Gyez came out of his own bedroom and took a lump of cheese from the refrigerator. That's right, they're herbivores, Ray thought. Or at least noncarnivores. He couldn't remember if true herbivores ate dairy products. "How's the book?" Gyez asked.

"I'm just starting on chapter four." Ray looked at Gyez, suddenly understanding why the writer had been so amused last night. "Uh, Gyez, how much research did you do on humans before you wrote this?"

"None," the writer said.

"'None'!" Ray yelped.

"How could I?" he asked in a reasonable tone. "I wrote it before you people landed here. I called the aliens the 'Khafup' and they were a kind of giant rodent."

"But, but—"

"My editor was about to send it to the typesetter when your *Gagarin* landed," Gyez said. "Thinking about sales, she made a few changes in my words and tossed in a few topical references. The Khafup became human and Ch'k'glunk became Climber Pinkskin. I didn't smell out the changes until the book was on sale," Gyez snorted. "By which time it was already a bestseller. Being so, I couldn't complain."

Ray groaned. "Keating thought the book showed the kya view of humanity. That's why he wanted it."

"Really?"

"Yes, really!"

"Hey, get calm, Bennet," Gyez said. "I can rewrite it for a human audience. Just tell me what needs to be changed."

"Change it?" Ray felt oddly scandalized. "But, but, I'm here to do a *precise* translation, Keating—"

"—never read it," Gyez said. "No one on Earth has. That being so, who'll notice any changes? And *what* changes? No one asked *me* about the changes in the original story. This is my chance to fix a minor embarrassment, I'd like to make Climber Pinkskin act like a *real* human instead of a funny-smelling rodent."

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"You would?" Ray asked.

"Absolutely," Gyez said. "I want to make my stories as accurate as possible. Being human, you make the perfect advisor. Now, what needs to be changed?"

Where to begin? Ray wondered. "Well, we don't have *a* language, we have many—"

"But the folks at your embassy all speak the same language," Gyez said.

"That's English," Ray said. "It's convenient for us to use one language, but we have others. We don't call any of them 'human' the way your characters do."

"English," Gyez muttered. The notepad came out and an entry went in. "What else?"

"We don't eat raw meat. Well, there's a raw-fish food called sushi, but we almost always cook meat to improve the taste and to make it easier to digest." Ray watched as Gyez scribbled more notes. "And English isn't hard to learn, there's this joke that it's so simple that anyone can learn it, even Americans. We don't go around barefooted, not usually, and 'Climber Pinkskin' isn't a human name at all."

"I thought my editor had a stroke of genius there," Gyez said. "The scent name reminds the readers that humans evolved from tree-dwellers, and the follow name gives an idea of its appearance."

"First name and family name," Ray said, and sighed as Gyez made another note. "Look, why don't I finish reading the book before we go into the details?"

"Good idea," Gyez said.

"Right now I have to visit the embassy. I need to pick up a few things." And get some advice, Ray thought.

"I can give you a ride," Gyez said. "I know the way."

Ray found himself in a wheeled metal shell, powered by a motor which burned—or exploded, to judge by the noise—wood alcohol. Guidance was done by Gyez, who held a tiller-stick in his hands. Ray found it difficult to watch the writer's driving; the seat cushions tilted as much as the kitchen stool, and he kept sliding toward the car floor. He finally found a position which was halfway comfortable, but by the time they reached the embassy his legs were stiff. "I'll get a ride home from somebody else," Ray told Gyez after he got out of the car.

"Fine, scent you later," Gyez said, and drove off.

The UN embassy was a large, roomy building, filled with human furniture, human architecture, human beings. One day and I'm already homesick, Ray thought, suddenly annoyed with himself. He checked the lobby map, pressed the button for Nyquist's office and followed a glowing line which appeared in the air.

Nyquist was in the middle of some paperwork, but he put it aside as Ray entered his office. "Dr. Bennet, hello, have a seat. What brings you here?"

"A seat," Ray said, sitting in front of the desk. "And a few other things, like a bath. And a serious problem."

"How serious?"

"Have you ever read *Roam to Infinity*?"

Nyquist smiled. "Yes. It's rather amusing, in a perverse way. Most of my

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staff—'' He put a hand to his face. ''Good God.''

Ray nodded. ''It's the book I'm here to translate. Keating bought it blind.''

''And he wants to publish it—no. The UN cannot permit this. The diplomatic repercussions on Earth would be unacceptable. Not only does that book make the kya look ridiculous, it makes them appear to despise humanity.'' Nyquist looked at the ceiling, as if seeking out a helpful deity. ''With such a vast literature available, why did Keating have to select trash?''

''Money,'' Ray said.

''What else.'' Nyquist looked at Ray. ''How could you possibly agree to translate that book?''

''I didn't,'' Ray said. ''When Keating hired me he said there were no copies of it on Earth. He bought it on the basis of his market research. I never saw a copy until yesterday.''

''How very odd,'' Nyquist said coolly. ''Perhaps Keating can be persuaded to choose a different book.''

''Gyez won't like that,'' Ray said.

''I know,'' Nyquist grimaced. ''He will be financially hurt if that book is not published, and that will also create a diplomatic incident. Certain kya politicians would make much of it. But publication would be far worse. And it would do you no good to be associated with this affair,'' Nyquist added pointedly.

''Gyez wants to rewrite the book,'' Ray said. ''He says—well, he knows a lot more about humans now. He'd like to clear up the inaccuracies.''

''Inaccuracies, indeed,'' Nyquist said. ''Such as a human who hangs by his tail from the rafters.''

''I haven't read that part yet,'' Ray said weakly.

''That is your good fortune,'' Nyquist sighed. ''When Keating's agent was here, no one asked her which book she wanted. We minded our business and assumed Ms. Franklin would show good taste—no matter. I must discuss the situation with Keating.''

''There's something else,'' Ray said.

''Something—ah, the bath. And other amenities, no doubt.'' Nyquist touched his desk intercom button. ''Delores, Dr. Bennet will need some assistance.''

Ray stepped out of the office and was met by a pretty young redhead sporting a fashionable Mohican haircrest. She had creamy skin, which Ray thought would burn badly if she spent too much time under Kya's hot F2 sun. ''Having a few problems, are we?'' she asked.

''This morning I discovered why the kya don't have a word for 'bathtub,' '' Ray said. ''Or 'shower.' ''

''They have the words.'' Delores led him down the corridor. ''They borrowed them from us. But didn't you know they bathe by dusting their fur with talcum powder?''

''I knew, but I managed to forget the implications,'' Ray said.

''That happens to lots of people,'' Delores said. She opened a door and took him into a storage room. She began handing him cartons from the shelves. ''No, don't tell me what you need, I can guess. Shower. Power pacs. Chair. Pillow. Gas pills—''

''Huh?''

''Imagine how the kya feel about flatulence.''

''Oh.''

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"Electric adapters. Neutral deodorant, soap, and toothpaste. Did you bring along a laundry?"

"Built into my suitcase."

"Good, we're out of them. Water hoses. Water heater. Water bed. That should do it."

"It does," Ray said, balancing an armload of cartons. "Except I'll need a ride."

"That's why I'm here," Delores said.

A few minutes later Ray was riding home in a human car, listening to Delores as she told him how to set up and use his supplies. "You'll still have problems," she concluded. "When you do, give me a call at extension thirteen. Anyway, I hear you're a translator?"

"That's right," Ray said. "Keating Press hired me to translate a kya book."

"Really? Maybe it's one I've read. What's the title?"

"Roam to Infinity."

"Urk!"

Ray cringed. Delores was attractive and pleasant, and it had just occurred to him that there were few women on Kya. Linking himself with Gyez's book might not be his best move. "Gyez wants to rewrite it for a human audience," he said.

"He'd do better if he burned it," Delores said. "I'm not kidding. That book would give folks back home the wrong idea about the kya. It makes them sound like racists."

"We can clean it up," Ray said. "And Gyez isn't a racist."

"No, he's just a hack writer." The car stopped in front of Gyez's house. Delores got out and helped Ray pick up his supplies. "I'm sure he's a nice guy, and if you read that book in the right way it's funny, but anyone who takes it seriously will have a fit." She got back in the car and drove away.

Fumbling with the cartons, Ray went inside Gyez's house. The front door was open and Ray heard an odd noise as he went to his room: *clack-clack-clack, whck, clack-clack, whck, clack-clack-clack, whck*. He put the packages down and went to investigate.

Gyez was in his office, pecking away at a finger-powered typewriter. "New story," the writer said. "What you said about a puking taboo gave me an idea. How were things at the embassy?"

"All right. I picked up some things I needed."

"Good. Say, Bennet, is human—er, English—as easy to learn as you said?"

"The basics are easy," Ray said. "It has some odd constructions, but no more than Wideplain. Do you want to learn it?"

"Yes." Gyez leaned back from the typewriter. "Visiting the city library last week, I saw a human science journal on display. Thinking about it, I suppose it could have some good story ideas. And it might be interesting to read some human science fiction. Speaking of science fiction, I'm leading a party here tonight. You being human, some other writers want to meet you."

Ray blinked. "Science fiction writers?"

"Of course! That's one reason I insisted on working with a human translator," Gyez said, and snorted in amusement. "None of us have ever met a human before. The people at your embassy are always busy talking to politicians, or industrialists, or scientists.

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Never writers. With Keating offering this deal, I saw a chance to let us all meet a real alien."

"Not just yourself?" Ray asked.

"We're all science fiction writers, aren't we?" Gyez sounded puzzled. "This is good for all of us. Learning firsthand about an alien culture, we can all do better writing, and give one another new ideas."

This must be the kind of thing Nyquist told me about, Ray thought. Perhaps it was natural for herd beings to share their good luck. And—"So this is why you wanted me here."

"I said it was *one* reason, Bennet," Gyez said patiently. "Having some pride in my work, I want to do a good translation. Especially if I can get rid of the stupid parts! And, er, you don't mind being a special guest, do you?" he added.

"Why should I?".

"That's the spirit!" Gyez snorted. "I had a clause put in my contract letting me reject any translator I didn't like. I'd feared I might have difficulties."

"Difficulties?' "

"Yes. Franklin—the human Keating sent to arrange the contract—seemed rather uncommunicative. Being so, I was afraid other humans might act that way, in which case working with a translator would do us no good. I'm glad I was wrong," he added.

Ray nodded. "When does the party start?"

"Sunset. There's plenty of time." Gyez went back to his typing.

Ray went to his room and opened the shower. While it constructed itself he hooked up the water hoses to the bathroom tap and drain, and plugged the water-heater can into the line. A minute later he was taking a shower and wondering what he had got himself into.

They told me it was safe to drink kya vodka, Ray thought as his eyelids creaked open. He had blurred memories of the past night, of answering interminable questions before staggering back to his room to pass out. Ray asked his closet for a hangover pill, and took a shower while he waited for the medicine to take effect.

A memory came to him as the water sprayed him. He had displayed the shower to a dozen kya. Half of them had been interested in the featherweight shell and the cybernetic controls, while the other half had been fascinated by the human custom of water-bathing. Ray recalled declining to demonstrate the custom.

Ray toweled off, dressed, and went to the kitchen. A couple of Gyez's friends had fallen asleep in the living room, in the facedown crouch suited to the kya physique. As Ray ate breakfast one of them stirred, rose, and shuffled into the kitchen. "Bennet," she whispered. "Don't humans get hangovers?"

"I took a detoxifying pill." Lyu, he thought, that was her name. She had tawny fur, brushed with something to turn the ends silver. The fur on one side of her muzzle was matted from where she had slept on it.

"A cure." Lyu gasped. "I want it."

"I'm afraid it would poison you."

"That's a cure, too." Lyu raided Gyez's refrigerator for a bottle of fruit juice. She drank, shuddered, and sat facing Bennet across the table. "Some party. What did you think?"

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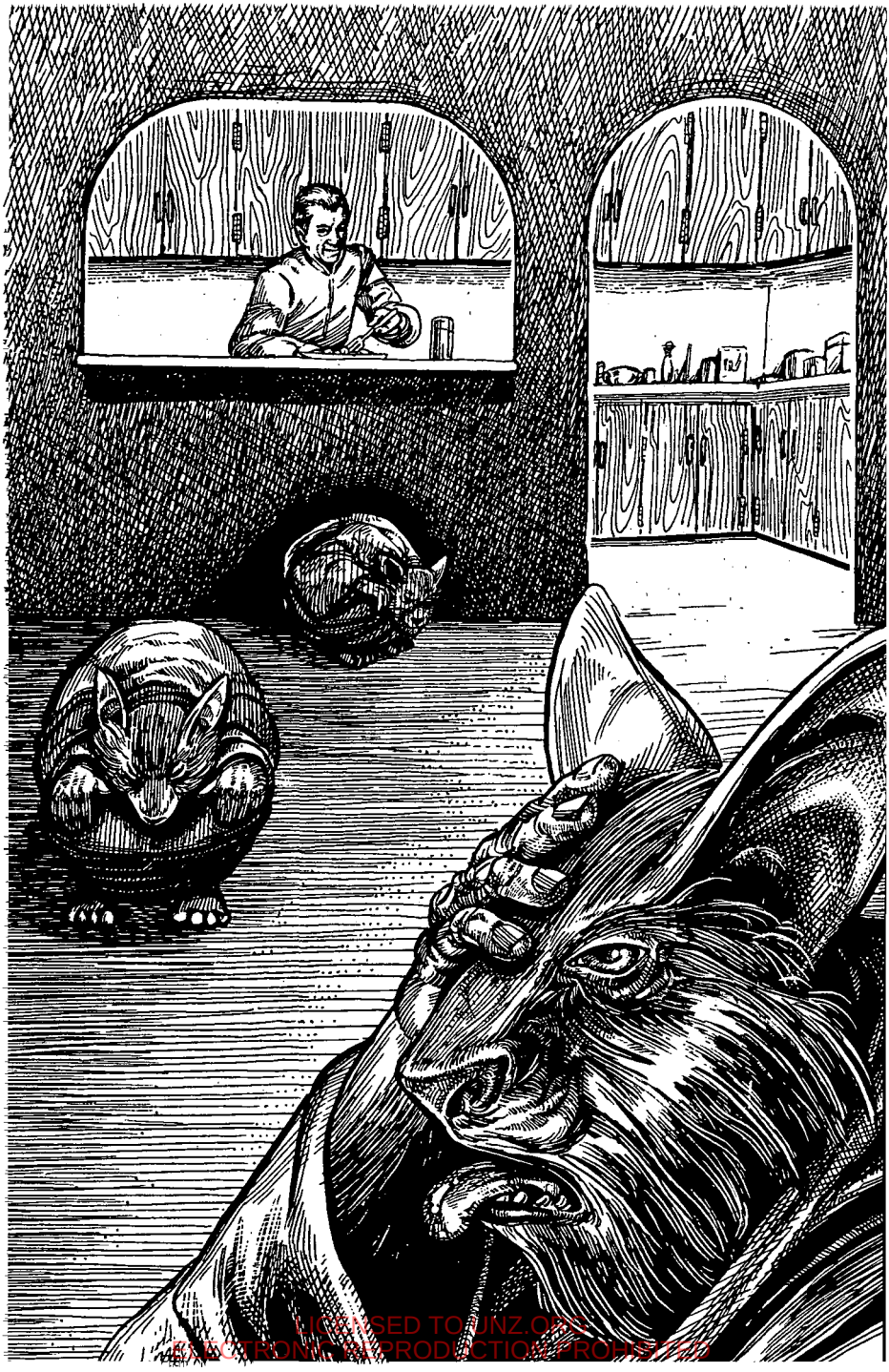

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Ray arched an eyebrow. "That's the first time anyone asked me that."

"Asked you what, Bennet?"

"What I *thought* about something." Ray said. Lyu winced, and Ray lowered his voice. "All last night it was, 'Bennet, aren't shoes uncomfortable?' 'What are some human slang terms for robots, Bennet?' 'Bennet, what does it smell like inside a starship?' Nobody asked me *why* we wear shoes, or what I thought about Kya, or anything else worth discussing."

"What *does* it smell like inside a starship—no, that's right, humans don't have a sense of smell."

"We have one, Lyu. It's just not as good as yours."

Her nostrils flared. "I wonder why not?"

"Evolution," Ray said, dredging up a memory from his high school biology class. "Our ancestors lost it when they evolved intelligence. The theory is that without a good sense of smell to warn them about predators they needed something else to keep from being eaten, so they had to improve their brains."

"Unlikely," Lyu said. "We evolved intelligence without weakening our smell. Besides, a mind needing all the sensory data it can get, the weakening of a sense would be counter-evolutionary. Certainly senses improve as one travels the evolutionary path."

"I wouldn't know," Ray said. He recalled that he'd pulled a *C-* in biology. "I'm not a scientist."

"It's a proven fact—" Lyu's muzzle wrinkled thoughtfully. "Biologists being kya, it is natural they call it proven. Forcing the brain to improve by *weakening* the senses—I'll bet there's a story in that."

"Could be," Ray said.

"Yes." She sniffed happily. "By the way, I wanted to ask something. How well do you think Gyez's book will do on Earth?"

Ray shook his head. "I couldn't say."

"Oh." She sniffed. "If it does well and there's an audience, maybe I could publish some of my own stuff there. Being a publisher, would that interest you?"

"I'm not a publisher," Ray said. "I'm just a translator."

Lyu's muzzle wrinkled in confusion. "But you work for a publisher."

"I was only hired to translate the one book."

"But you joined with Keating—oh!" Lyu winced at her own exclamation. "Of course, *aliens*, you'd have different business arrangements than people do. I know there's a story in *that*. Thanks for the chat, Bennet." She got up and left the kitchen.

Ray finished his breakfast and went to his room. Time to work, he thought. After the chair built itself up Ray sat down with *Roam to Infinity* and his computer. He had decided to do a rough, quick translation first, sticking as close as possible to the kya original. He thought that would take at most a week. The book was fairly short: unlike human fiction, kya storytelling was not yet afflicted with elephantiasis.

"This had better work," Vha muttered as he prepared to engage the drive. The hostile Quargiat supership

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loomed large in the televiewer. "Doctor, are your calculations done yet?"

"Almost," Zark mumbled, his pencil scribbling furiously.

"You have a plan?" Climber inquired suddenly.

"Yes," Vha informed it. "We may yet run through this alive."

"How?" Teh asked.

"Simple, scented one," Vha explained gallantly. "Your father thinks Roamer *can fly through the outer layers of Quargiat's sun. Those monsters can't follow us there—but they'll try!"*

"They hate us that much," Gack muttered. "But can we survive?"

"That doesn't matter," Vha said. "We must stop the Quargiats here and now, before they can conquer the galaxy. Destroying their super-ship will cripple their fleet and show them they can't win. Whatever happens to us, we'll save billions of people from slavery."

Its footfingers clutching a stanchion, Climber listened in silence. Admiration for the kya and their unique qualities suffused the alien. No race in the galaxy could match them for courage or herd-feeling, or for the self-sacrificing wisdom which would save so many races from doom. We humans have much to learn from the kya, Climber thought.

It was a relief to have the phone ring. Ray pulled the card from his pocket. "Bennet here."

"Doctor, this is Delores at the embassy. You just had a call from Mr. Keating."

"I did?" Ray found himself smiling at the first human voice he had heard in six days. "Did he leave a message?"

"Just that he wants to talk with you. He said he wants to know how you're doing with *that book*."

Ray looked at *that book*. "I'll have the rough translation finished in a few hours, but—"

"You don't need to tell *me*," Delores said. "Mr. Keating is waiting for your call, but you'll have to come down here to make it. We can't patch the phone net into the FTL communicator."

"I'll be there in a few hours," Ray said. Then, hoping to get on Delores's good side: "Do you know if Nyquist convinced Keating to pick a better book? *Roam to Infinity* is giving me a swift pain."

"I'm afraid Mr. Keating still wants that book. Good day, Dr. Bennet."

Ray went back to work. Zark finished his calculations before the Quargiats could blast *Roamer* out of existence. Vha flew the ship through the star's outer layers, pursued by the enraged aliens. *Roamer* burned out several tubes while the Quargiats boiled into vapor. Gack joked about the way the Quargiat-smoke must make the galaxy stink, and Vha declared his undying love for Teh. *Roamer* shaped course for home and the book ended.

Ray saved the translation and turned off his computer. There was one good thing about the translation, he mused. Once Keating read it he would have to change his mind about publishing the damned thing.

And then what? One alternative came to mind. Feeling pleased with himself, Ray pocketed his computer and went to Gyez's office.

Gyez looked up from his typewriter

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as Ray came in. "What's up?" the writer asked.

"I need a ride to the embassy," Ray said. "They called and said Keating wants to talk with me."

"Fine, I have to go into town, too." He got up and led Ray out to his car. "Any idea what Keating wants?"

"He wants to know how the translation is going." Ray climbed into the car, wedging his legs into a not-overly-uncomfortable position. "I just finished the rough translation, so he can look at that."

"Great," Gyez said as he started the motor. "That being done, we can start on the rewrite tonight."

"Maybe. Gyez, I've been thinking. Keating is interested in a book—"

"—which shows our view of humanity. Yes."

"Have you got anything else on that topic? Something that might be more appropriate than *Roam to Infinity*"?

"Well . . . " Gyez worked the tiller back and forth, swinging the car around some potholes. "I've got something I wrote during the Human Crisis—"

"Great!"

"Not great. Being too controversial, *Nightscent* was never published. The publishers all said things like 'Great book, loved it, but it's not quite right for us, good luck somewhere else.' "

"Oh?" Ray felt interested despite himself. "What was the problem?"

"They were afraid it would offend humans. You sniff—well, how much do you know about the Human Crisis?"

"Not much. It's been a few years."

"OK. A year or so after your folks landed here they set up a research base. It looked like a military barracks. Everyone there acted like soldiers and maniacs. Being so, we thought it was an outpost for an invasion. Scary! Creepy."

"Now I remember," Ray said. On Earth it was known as the Kya Crisis. The UN had set up a minimum-budget base, bleak, cramped, and isolated. Eventually the personnel had suffered a kind of mass psychosis. With no other specimens of humanity to observe, the kya had assumed that the staff's behavior was typical of mankind. "So you wrote about a potential invasion?"

"No, I wrote about a fellow who resolved the Crisis, despite opposition on both sides and a good deal of action. Znav, the hero, found points where the two races had much in common."

"So it's about humanity?" Ray asked. His hands clutched the seat as the car sped around a corner.

"Not directly. Oh, I did research, reading what I could find and talking to people who'd studied your base, but that was for background. Writing it to comment on kya foibles, I used my observation of humanity to make points about us. It's some of the best writing I ever did," he added.

Ray felt amused by the writer's ego. "So why wasn't it published?"

"By the time I finished it the publishers were scared to say anything that might provoke humans. I even had to stop writing about Climber Pinkskin, thank the Name of Names. Why? Were you thinking of offering *Nightscent* to Keating?"

"Possibly—but not until I read it." Ray added hastily.

"You're afraid it's worse than *Roam*

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to Infinity?" Gyez snorted. "It isn't. What could be?"

"Uh—" Ray shook his head. "You don't have a high opinion of *Roam to Infinity*, do you?"

"I told you about the changes in it." Another snort. "And I only wrote it to pay the rent. I never planned on a whole series! The *Roamer* books are fun, they make me rich—well, financially free, let's say—but as far as I'm concerned they're just outriders on my real work."

"So you wouldn't be too upset if Keating printed a different book?"

"Not as long as I get paid."

Writers, Ray thought in despair.

After Gyez dropped him off at the embassy Ray went inside and found Delores. "Are you ready to make your call?" she asked him.

"Yes." He smiled. "And I think I can get Keating to change his mind about the book."

"Can you?" she asked, as she led him down a corridor to the communications room. "Everyone would appreciate it. Mr. Nyquist has been beside himself. The secretary-general has called him twice this week."

"Has the kya government said anything?" Ray asked.

"They don't know about this yet—I think," Delores added uncertainly. They came to the communications room and she opened the door for him. "Good luck making Mr. Keating see reason."

"Thanks." The door closed behind him and Ray sat down at the FTL communicator. It looked like a standard home telephone, and it operated like one: Ray tapped in Keating's number and found himself looking at the publisher. "Ah, Dr. Bennet. How goes the work?" Keating asked.

"I've finished the rough translation —"

"Good!"

"—but Gyez and I have a lot of work ahead of us. It's not ready for publication—maybe it never will be. I've got to tell you that *Roam to Infinity* stinks."

"Yes, I've heard that from the secretary-general." Keating stifled a yawn. "Not that I need his literary opinion."

"The S-G was talking diplomacy."

"I don't need that, either." Keating's image tapped a bony finger against his desk top. "I'm in the publishing business, not the literary business or the diplomacy business."

"Business," Ray repeated. He got out his computer. "Hook in your modem and I'll send you my rough translation. Forget about your market analysis. Just read it. Then ask yourself what crud like this will do for business."

"I'll read it," Keating said. He reached somewhere out of view. "OK, send it."

There was a gentle hum as the computer downloaded the manuscript. "Gyez has written other books," Ray said. "I haven't talked much about them with him, but I understand some of them deal with humans. I'm sure one of them would be better than this dog. Why don't I look them over and send you some summaries?"

"I'll consider that," Keating said. "Let me have the final translation as soon as you can. Goodbye." Keating hung up.

Nyquist was waiting in the hall when Ray stepped out of the comm room. "Delores just told me about your call."

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he said to Ray. "Did you persuade Keating to forget about that book?"

"No, not yet."

"I see. Doctor, this is a delicate situation. Would you consider breaking your contract with Keating?" Nyquist held up a hand before Ray could protest. "The UN will cover all of your expenses, so you won't suffer financially. The secretary-general thinks it's a small price to avoid an incident."

"I don't know," Ray said. It was tempting, but—"What will the kya think if I break the contract? Won't it look like—"

"Your contract is with another human being. We can present it as a dispute between the humans."

"Gyez will catch the short end," Ray said.

"We can reimburse him for his losses," Nyquist said. "Quietly, of course. Er—do you happen to know how much he expects to earn from that book?" Nyquist scowled as Ray shook his head. "Doctor, you seem to get along with him. Perhaps you could raise the matter."

"I'll try," Ray said tiredly. "Right now I need a ride home."

Robot drivers make poor conversation Ray thought, as a UN car took him home. The panel's lights pulsed indifferently, leaving him alone with his thoughts. He didn't like the idea of breaking a contract. Aside from what the kya might think, it ran against his grain. More to the point, he doubted Gyez would agree to Nyquist's suggestion. The writer would expect to make a tidy sum from this book, as well as from any others which were reprinted on Earth. He wouldn't want a relatively tiny pay-off.

For that matter, Ray had similar expectations. The terms of his contract gave him royalties from the book, but they were linked to Gyez's earnings. Even—or especially—if *Roam to Infinity* created a scandal, he mused, he could still turn a profit.

The car deposited him at Gyez's house. Ray returned to his room and went to work on the translation. He didn't know much about writing, he thought, but he knew what annoyed him. He began toning down the lurid prose, labeling Climber Pinkskin as "him" instead of "it," dropping adverbs and trimming the flowery way in which people said and asked things.

It was late in the afternoon when Gyez came into the room. "Hello, Bennet," he said, sitting down on a stool. "What did Keating say?"

"He said to hurry up with the translation."

"I never met a publisher who wasn't anxious," Gyez said. "Anyway, I've been thinking about Climber. Maybe I can say it's a nickname, that he does an unusual amount of climbing even for a human."

"Most of us don't climb—wait, you could say he's a rock-climber."

"A rock-climber?"

"Yeah, it's a sport. People climb sheer cliffs with their bare hands. There are some nuts who like that."

"Indeed?" Out came the notepad. "Why?"

"Search me, Gyez. I *said* they're nuts."

"But there must be a reason," Gyez insisted. "An atavistic wish to return

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to the trees? A need for danger? An urge to see things from a new perspective?"

"Gyez, I don't know. I'm not a psychiatrist." Ray shook his head. "Look, there's something we have to talk about."

"What?"

"I had a talk with Nyquist. The UN is unhappy with the book."

"They've read it?" Gyez sniffed thoughtfully. "I thought there weren't any copies on Earth."

"Most of the embassy staff has read it," Ray said. He spoke carefully; he'd given a lot of thought to how he should phrase this. "They're concerned that people, uh, humans, might take it the wrong way—"

"Take what the wrong way?"

"Climber Pinkskin. He reads like a parody of a human being. The fear is that folks on Earth might think Climber represents the typical kya view of us."

"I see what you mean. But we're rewriting Climber, remember? So what's the problem?"

"The folks at the embassy are nervous. It's their job to be nervous, to think about what could go wrong and stop it. Anyway Nyquist was talking about paying us to stop the project."

"He said that? But Keating and I have a deal. We even signed a human-style contract. I know people say science-fiction writers are weird, but that's carrying it too far." Gyez paused, took off his glasses and squinted at the lenses. He polished them against the fur on his forearm. "I think Nyquist's concerns are clogging his nostrils. Thinking I'm the sort of idiot who breaks a good deal, who'd do business with me again?"

"I didn't think you'd accept," Ray said. "One thing Nyquist suggested was that *I* break my contract with Keating. That way there'd be no book, and no one would blame you—"

"—but they'd blame you, wouldn't they?" Gyez put his glasses back on. As far as Ray could tell the lenses were as filthy as before. "We can't have that, Bennet. Where would it leave you? Besides, there won't be a problem after we rewrite the parts about Climber, will there?"

"No, I suppose not."

"Exactly. This is just one more reason to do a good job here." Gyez moved his stool alongside Ray's seat. "That being the case, we should start working, shouldn't we?"

"I'm crazy to do this," Gack said as he entered Roamer. *Being nervous, he sniffed rapidly as he checked the smells of the cabin. Plastics filled the air, and ozone added the promising scent which follows a summer storm.*

"Crazy," Gack repeated, and turned to Zark. "Are you sure this is a good idea? I mean, why go into space?"

"If I could answer that, there'd be no need to go," Zark said.

"But you must expect to find something," Gack said. He waved a hand around the cramped cabin. "This shows you're a genius. Being a genius, wouldn't we all be better off if you turned your attentions to more immediate problems?"

"Father's work here has already given the world atomic energy and new super-alloys." Teh said. Sitting at the controls, she spoke as she ran the final tests. "You can expect more wonders."

"Gack still raises a good question," Zark said to her. "Why do I run off in

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my own direction, sniffing out problems no one else can scent? I admit I've often felt selfish in devoting my talents to space travel when there are so many other problems. Yet I have always thought everyone is best served when some of us act like mavericks. It's a hard life, but the rewards are great for all.''

Listening in silence, Vha felt a sudden empathy with the elderly scientist. Zark had expressed his own feelings perfectly.

But not to me, Ray thought as he reread the printout. The passage made perfect sense to a kya, but Ray knew he was missing something.

Ray looked around the embassy lobby and checked his watch. Fifteen minutes. The staff was expressing its displeasure with him by making him wait. That wasn't going to make it easy for him to ask them for advice.

Eventually Delores came out of her office. ''Well, Dr. Bennet,'' she said as he stood up. ''Having some trouble, are we?'' Ray thought she sounded maliciously hopeful.

''Yes,'' he said. ''Gyez and I have been rewriting the book—''

''I thought you'd given up.''

''No. I signed a contract, and until Keating scuttles the project I'm honoring it. So is Gyez—when you see Nyquist, tell him Gyez won't have anything to do with what he suggested.''

''I see.'' She started to turn away.

''Wait,'' Ray said. He held out the printout. ''I want to know if you can explain something.''

''What?'' Delores took the paper, glanced at it, and frowned. ''Is this part of *that book?*''

''It's part of the rewritten chapter now. Zark is explaining why he's built a starship. His motive makes no sense to me—I guess I don't understand the kya as well as I thought I did. And Gyez can't explain it to me any more than I can explain why some dingalings enjoy rock-climbing. He thinks it's plain as day.''

Delores read the page. ''Oh, *that*,'' she said after a moment. ''You have to understand that the kya are a good deal more socially oriented than humans. When they do something, they consider how it'll affect the people around them.''

''They're not all like that,'' Ray said.

''There are exceptions,'' Delores agreed. ''Criminals, sharp operators, and so on. Zark is saying he's afraid his work appears selfish because it serves a long-range good only he can see. He's the sort of oddball who can ignore herd feelings, at least to an extent. Vha is saying he's the same way. This conflict between self and group is a major theme in their *real* literature,'' she added, returning the paper.

''I'm still missing something,'' Ray said. ''Look, most humans worry about what the neighbors think, about appearances, and things like that. The kya—''

''—make that look like raging egoism.'' Delores waved a hand. ''No, I'm exaggerating. I'll give an example. Have you ever heard the phrase 'Take the money and run'?''

''That's a sentence, not a phrase—'' Ray closed his mouth and nodded. ''I've heard it.''

''Not on Kya. To us, a 'fair deal' is

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one where I profit at your expense. To the average kya, a fair deal is one where both sides come out ahead. When a kya makes a business proposition, he tries to make it as attractive as possible to the other side."

"And he tries to arrange the best possible deal for his friends, too?"

Delores gave him an odd look. "Naturally. Why?"

"I've been—never mind." Ray didn't want to explain his role as resident alien . . . and something odd was going on here, he thought. He put the paper into a pocket. "Thanks for the advice."

"Not at all," Delores said. "I hope it gives the book some socially redeeming value." She went back to her office.

Ray decided to walk home, both for the exercise—he'd done a lot of sitting lately—and to give himself time to think. Nyquist must have known that Gyez would reject any suggestion of breaking a contract. Knowing that, why had the man made the suggestion? It seemed impossible that an experienced diplomat could be so clumsy. Perhaps it was really a move in a subtle plot to destroy human-kya relations. Ray imagined himself turning around, storming into Nyquist's office and forcing the man to confess to a role in some nefarious conspiracy—

I sound like one of Gyez's characters, Ray thought in irritation. The reality was that the diplomat had been casting about for a way to defuse a potentially embarrassing situation. His suggestion had been an effort to try one option, even if it was a long shot.

Maybe there won't be a problem, Ray told himself. Gyez was eager to fix the howlers in *Roam to Infinity*, and when you got down to it, he wasn't the worst writer in the world. Ray had dipped into some of his other books, and although they were only science fiction Ray could see that the writer had talent.

Of course *Roam to Infinity* would never be mistaken for literature, Ray thought, but even so it was no worse than a lot of human writing. The book was filled with the same type of mistakes that human writers had made for centuries in portraying people outside their own society. No wonder Delores and Nyquist were unhappy; the shoe always pinches on the other foot.

Over the next four weeks Ray and Gyez fell into a pattern. The writer would wake up around noon, and for the next two hours he and Ray would work on the translation. Their progress varied, and more often than not they would bog down over a single paragraph or sentence. Things slowed down even more as Gyez began to learn English; the work sessions doubled as language lessons, and Gyez began to kibitz in the translations. He deferred to Ray on matters of style, but he had his own opinions on other points.

"I don't care," Ray said one morning. "You can't say that the *Roamer* gets its power from radium, even if you mix it with this Fastpaced Alloy, whatever *that* is. Reactors don't work that way."

"Who said anything about reactors, whatever they are?" Gyez said. "Being a genius, Zark can extract the power latent in all frangible elements."

"Can't we just call it plutonium?" Ray asked. "That way we could skip all this explanation on how the reactor

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works. Nobody needs to know it, and anyway your explanation is wrong."

"Really? Prove it."

"Uh . . ." Ray suddenly realized how little he knew about nuclear physics. He had already disappointed Gyez on several occasions; the writer had the unreasonable belief that a human should know everything about human science and technology. "Look, I just know that we can't extract power from radium—"

"But Zark can!" Gyez said in triumph. His nostrils flared as he got an idea. "Being so, that gives Climber White another reason to stay with the crew—to see how Zark does it. We'll call it a frangibles-guider and skip the explanations, will that do?"

" 'Fission inducer' will sound better in English," Ray said. He reached for his computer and typed in a sentence, then paused. " 'Frangible-inducer.' Is that something you made up?"

"I had to." Gyez snorted in amusement. "If there already was such a thing, *how could Zark invent it?*"

"What I mean is, how did you come up with the term?" Ray sensed the beginnings of a scholarly article, say, *The Formation of Neologisms in Wideplain, with Reference to Literary Applications.*

"Oh, I just fool around with the words until they smell right. You know, easy to pronounce, with a good technical sound. Needing new terms in English, what do you do?"

"We adapt old words, or words from other languages. Or we form an—uh. Wideplain doesn't have a word for *acronym.*"

"Meaning what?"

Ray's phone rang, saving him from an explanation. "Bennet here."

"Doctor, you've had another call from Mr. Keating," Delores said. "He wants to talk with you about *that book.*"

"I'll be down later," Ray said.

Gyez drove Ray to the embassy, receiving an informative and entertaining lecture on acronyms before their arrival. "I'll wait here," Gyez said as he parked the car.

Ray went directly to the comm room, skipping the formalities with Delores and the rest of the staff. He sat down at the FTL communicator, and in a minute he was facing Keating. "We're two-thirds of the way through the final translation," Ray told the publisher.

"You are?" Keating looked amused. "Well, you can stop working on that."

Ray sighed. He had known the work would be wasted, and yet . . . "The UN got you to kill the project?"

"Are you kidding? I sent the manuscript to the typesetter—"

"*What?*"

"Your rough translation was so good that I decided we didn't need a final version," Keating said. "Sorry I didn't tell you, but things got so hectic—"

"How could you do it so fast?" Ray asked. "I thought it took a year or so to schedule—"

"Oh, usually I set the printing schedule that far in advance, but, well, I'm eager to see *Roam to Infinity* on sale, especially after I heard that Asgard Books was in the market for kya sci-fi. Have to beat out the competition, y'know." Keating smiled. "I bumped a cookbook from the schedule—well, I won't bore you with the details."

"All that work we've done—"

"Yes, I'm sorry about that. All you

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can do is get to work on the next translation."

"The *next* translation?" Ray stared at the image on the screen. "Aren't you going to wait to see how badly this book does?"

"The market analyses project excellent sales. We're putting a hundred thousand copies on sale in two months, and we're gearing up for a second print run. Had to bump a 3V star's bio from the schedule for that. Anyway, I want you to translate the sequel to *Roam to Infinity*, whatever it's called."

Ray felt lost. "I *know* you haven't talked this over with Gyez."

"I don't have to. His contract gives me an option on his next book. I'm exercising that option. Good day, Doctor." The connection broke.

Completely distracted, Ray left the embassy and went to Gyez's car. "What did Keating say, Bennet?" Gyez asked as he got in.

"The book's being published." Ray felt ill. "He's using the rough translation."

Gyez closed his eyes and exhaled hard, as if to clear a stench from his nostrils. "After all the work we've done! And he was supposed to wait for the final translation!"

"I know. It isn't all bad, Gyez. The first print run is a hundred thousand copies, and Keating said there'll be a second printing soon. And he wants a translation of the sequel."

The writer didn't seem mollified. "And what of this diplomatic incident your UN fears?"

"I don't know." Ray looked out the window at the embassy. The sloping car seat aided him in his urge to sink out of sight. "Let's get out of here before they spot me. OK?"

"Yes, certainly." Gyez started the car and they drove off. "I can't say I'm happy. Acting this way, is Keating treating my work as a joke? Is there anything I can do to keep him from publishing the rough translation?"

"I don't know. Maybe there's something in your contract." Ray sighed. "Maybe you could ask your—" He stopped, puzzled. "Wideplain doesn't have a word for *agent*."

"For what?" Gyez had made progress with English, but his vocabulary remained limited.

"*Agent*," Ray said, and went back to Wideplain. "An *agent* deals with publishers, gets the best possible deal for a writer, looks for new deals. He gets paid one-tenth of your earnings—"

"What!"

"—so he has a motive to help you make as much money as possible."

Gyez sniffed appreciatively. "Handling the paperwork, an *agent* would leave me more time to write, too. That's a nifty concept."

And, Ray decided later, it was one desperately needed on Kya. That revelation came to him as he stood in Gyez's office and slogged through the contract the writer had signed with Keating —literally signed, Ray noticed. The kya ordinarily marked a contract with their scent, pressing a palm against the paper to leave sweat and body oils. Gyez might have done that here out of habit, but he had also written his name on the traditional dotted line.

The contract left much to be desired. "You can't stop publication," Ray told Gyez. "Once a translation has been

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turned in. Keating has full control of it."

Gyez exhaled. "Franklin—Keating's representative—told me only a smooth, final translation would be used."

"You didn't get that in writing."

"Verbal contracts being normal here, I didn't think that was necessary." Gyez looked philosophical. "At least I'll get paid."

"There's that, although I can't tell you what it'll come to." Ray glanced at the contract again. He couldn't tell if Gyez was to be paid a *rate* or a *fee*. The Wideplain word meant the same thing. "Whoever drew up that contract barely spoke your language. The grammar stinks."

"Franklin wrote it," Gyez said. "Reading it, I was annoyed by the phrasings, but I thought to straighten them out later. I'm not used to doing business human-style," he added apologetically.

"I sniffed that out—" Ray shook his head. I've been here too long, he thought.

"I'm other than happy about this," the writer said. "I won't sign another contract with Keating."

"You may have to." Ray looked at one specific clause in the contract. "You're required to sell Keating the rights to your next book. 'Exclusive option on all human-language translations of published works, which option may be exercised automatically at the discretion of the publisher.' *That* part is clear."

"That smelled so good when I signed." There was a bookshelf at the side of Gyez's desk. He pulled a book from it: *Roaming the Void*. "Having outsmarted myself, we may as well get to work on the sequel."

"You're taking this pretty calmly," Ray said.

"I'm not," Gyez told him. "I intend to sneeze all over Keating before this is through. But until I straighten out this mess I'm not going to break a contract. Keating may not care about his reputation, but I care about mine."

At first Ray mistook the pounding as part of his hangover. The previous night came back to him as a blur of commiseration, drinking, linguistics, and more drinking. He lurched over to the closet and took a hangover pill. The pounding continued unabated.

He heard Gyez answer the door. "Greetings, Earthlings. Now will you stop that damned knocking?"

"Where's Bennet?" Delores's voice demanded.

Ray stepped out of his room. "Right here," he gasped. He wished the pill would hurry up and kick in.

"You're under arrest." She stepped aside and Ray saw two UN Peacekeepers outside the door, their uniforms immaculate, their physiques imposing.

"Bennet is outside your jurisdiction," Gyez said.

"Guess again," Delores held up a paper. "We have a warrant from a local judge. Bennet, move or be moved." She gestured at the soldiers.

So she knows the difference between the active and passive voice, he thought. For his part Ray knew the difference between cooperation and resisting arrest. He staggered out of the house. The wet grass under his bare feet reminded him that it had rained last night and that

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he had changed into his pajamas before passing out.

The inside of the UN limousine was chilly. "Why am I under arrest?" he asked as the car started up.

"Mr. Nyquist will explain." Delores scowled at him. "Why did you teach Gyez to say *that*?"

"I told him a joke," Ray said. "You know. The one where you walk up to somebody, shake hands and say, 'Greetings, Earthling. I am a Martian. This is how we reproduce.' "

Delores looked shocked. "Are you aware on Kya only lovers shake hands? The sexual implications of a handshake—"

"I guess that's why Gyez snorted so hard when I told him."

"No kidding." Delores lapsed into silence.

Ray was marched into Nyquist's office. A kya was there, and Ray recognized him as Eldest Watcher Gavu, a prominent figure in the kya government. Gavu's muzzle furrowed as he caught Ray's scent. Ray wondered if he should take that personally, or if Gavu was reacting to his lack of a recent bath.

Nyquist looked up at Ray. "Are you aware that you may be involved in a felony?"

"No," Ray said in surprise. "What am I charged with?"

"I said *may be involved*," Nyquist said. "We're trying to determine the extent and conditions of your involvement. Are you familiar with the terms of the contract Gyez signed?"

"Vaguely. I read the thing yesterday."

"Being unclear, it is open to several interpretations," Gavu said. "One interpretation is that Gyez receives a small, fixed sum for his book, and nothing more. That is the interpretation favored by Keating's lawyers. This may be upheld by *human* courts. They may ignore our jurisdiction."

"It figures." Ray felt his knees grow wobbly. "Do you mind if I sit down?"

"Yes, I mind." Nyquist said irritably. He made a sharp gesture, and the chair which had rolled out of the wall returned to its place. "Maybe you're not smart enough to see the implications."

"I think I am," Ray said. Nyquist's irritation was nothing compared to what he felt. The arrest aside, he was cold and hungry, his mouth carried the classic hangover taste, and his bladder was starting to send distress signals. "Gyez is cheated. Other kya see this. What does it do to business, diplomacy, all that good stuff?"

"It makes chaos of them," Gavu said. "Scenting the crime of one human, people will grow suspicious of others. The isolationists will 'prove' that humans are all selfish, uncooperative mavericks. Our worlds will move apart, and I do not refer to orbital motions! And I am to believe you are an innocent dupe of Keating?"

"I am." Ray said. "I've been burned as badly as Gyez. Worse—my contract gave me a percentage of what he earned. What's five percent of nothing? Nothing!"

"If that's true—" Nyquist placed more emphasis on the first word than Ray liked "—you may be innocent. I'm afraid, though, that it may take some time to establish that."

Ray felt anger overcome irritation. "I thought the UN believed in 'innocent

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until proven guilty.' And the kya, too," he added for Gavu's benefit.

"The problem—" Nyquist began.

"Either charge me with something or quit jerking me around."

"You can be held as a material witness," Nyquist spoke with relish. "And that's a definite possibility. As it is, you cannot be permitted to leave Kya until this matter is cleared up."

"Now *wait*—"

"We plan our own criminal investigation," Gavu said. "You being a principal, your testimony will be required."

"So your passport has been impounded," Nyquist said. "It would be an unfriendly act if the UN let you leave Kya."

"A very unfriendly act," Gavu agreed. "We would have to extradite you. That would worsen things. The isolationists being active, they're already making Gyez's case into a major issue."

"Gyez doesn't want that," Ray said.

"The isolationists do, the stinkers," Gavu said. "We can't trust humans, they say. They don't understand cooperation and equality. They want to exploit us."

Events were taking Ray on a tour of unpleasant emotions, as his anger changed into frustration. "Gavu, have you discussed this with Gyez? He could clear me—"

"Gyez." Gavu exhaled, making his opinion of the writer clear. "Having more greed than sense, he dragged us into this mess. Dealing with him, I would look like an undignified fool."

"I see." Politics, Ray thought. Gavu might find a way to turn a crisis to his advantage, extracting concessions from embarrassed human politicians. Gavu wouldn't help end the trouble any time soon.

"You may leave now," Nyquist told Ray. "We'll inform you when you're needed again. By the way, until this matter is cleared up you can't reenter the embassy grounds."

"Why the hell not?" Ray demanded. "I'm a UN citizen—"

"Exactly," Nyquist said. "And this is UN territory. You have to remain under kya jurisdiction. Good day, Doctor."

Delores and the two peacekeepers were waiting outside the office. "I'm going to need a ride home," Ray said to Delores.

"I can't give you one," Delores said.

"You brought me here!"

"Under arrest," she said. "If we give you a ride home, it'll look like the UN—"

"I see."

"Mr. Nyquist wants us to appear completely detached from you."

"I get the picture."

Ray walked home in a foul mood. Persona non grata, he thought, that was the term. He wondered what Nyquist would do when his food stocks ran out in a month or so. A little starvation might remove him as a potential embarrassment, although even Nyquist might find that a little too extreme. And under kya law, he knew, he just might be liable to prosecution. He worked for Keating, and to the kya the distinction between employer and employee was a blurry thing. He didn't want to second-guess a kya court.

Things did not improve when Ray reached Gyez's house. There were a number of cars parked outside, and a

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number of kya inside. Ray knew them from the party Gyez had given. The writers glared and exhaled at Ray as he entered the living room, and Ray was suddenly glad that the kya were herbivorous.

"Hearing about your arrest, we came here," Lyu said. "The radio said you are under suspicion—"

"The radio?" Gyez asked.

"The news," another writer said. "Perhaps we aren't great news on human, but you folks are big news here. The word is you're suspected of fraud."

"Keating is," Ray said.

"You work for Keating."

"Under contract. The same as Gyez. Where *is* Gyez?"

"Right here," he said, stepping out of the misnamed bathroom. "Bennet, the news stinks. Your own embassy has dissociated itself from you."

"I know." Ray saw the implication in that. To the kya it would appear that the human race was rejecting him, a damning signal. "It's not what it smells like," Ray said.

"What *does* it smell like, then?" one of the writers asked.

"I think I know now," Ray said. "Gyez, how well do you know Nyquist?"

"I've talked with him several times. He . . ." Gyez shut his eyes and exhaled. "I know Nyquist through Franklin, the Keating *agent* who negotiated my contract. Franklin mentioned that Nyquist helped her to find me."

"And now Nyquist is afraid it'll look as if he helped Keating swindle you," Ray said. "He's trying to protect the UN's reputation."

"By cutting you out," someone said. There were exhales of disgust throughout the room. "Is that how the UN treats its citizens?" "Maybe we're better off not doing business with humans." "Smells like the isolationists are right."

"It's not the UN," Ray said. "It's just Nyquist. He's trying to cover up a mess. He isn't looking at this the way you would."

"Aliens," Lyu said, as if that explained it all.

"Aliens," another writer agreed. "The real problem is, what happens next?"

"I don't know," Ray said. "Gyez, that contract you signed gives Keating the exclusive right to publish your books on Earth. The right comes to him automatically. Maybe that can be undone in court, but it could take years. Keating can afford the best lawyers."

"Yes, he can," Gyez snorted. "But I have an idea. Being outraged, would you work for Keating again?"

"Hell will freeze first."

"Does that mean 'no'?"

"It means no."

Gyez took off his glasses and polished them idly on his forearm. "That being so, would you mind if I tell Keating your work is unsatisfactory?"

Ray felt puzzled. "What good would that do?"

"My contract gives me the right to choose a translator. Having that right, I can reject a translator as unsatisfactory." Gyez put his glasses back on. "I have a feeling that I'll find all of Keating's translators unacceptable."

Ray thought it over while the other writers snuffled appreciatively. It was a step in the right direction, but it left him feeling dissatisfied. Something more

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had to be done. Unfortunately nothing suggested itself.

The kya typewriter resembled the devices Ray had seen in old movies. He had never realized, however, that mechanical typewriters were stiff, slow, and lacked an *erase* key. The whole thing made any interruption welcome, even the reporters and newsreel photographers who showed up to interview Gyez. Gyez tried to absolve Ray of any blame, but Ray doubted he did any good; the news still referred to him as "the notorious alien translator."

The latest interruption came well after sunset, a week after Ray's expulsion from the embassy, when Gyez brought Delores into the room. Ray felt like a Devil's Island prisoner receiving a pardon. "What brings you here?" Ray asked.

"I thought someone should check on you," Delores said. "Unofficially. That's why I came at night. I didn't want anyone to see me."

"Thoughtful," Ray said, disappointed. No, he decided, thoughtless. Every kya in the neighborhood would catch her scent. We may know all the facts, he thought, but do we understand them?

"So," she said. "How are you doing? Are you having any trouble?"

"Just the usual."

"What usual?" she asked. "Are the kya—"

"I mean this nonsense with the embassy," Ray said. "The kya are fine. The neighbors don't mind having a monster from space on the block."

"They were unhappy for a while," Gyez said, "but I explained things to them. Human values are hard for them to understand, but being my job to explain alien concepts; I succeeded. Everyone is quite understanding."

"Maybe you should go into politics," Delores said. "Have either of you heard the latest news?"

"Not since this morning," Ray said. "The overgovernment was talking about suspending a trade agreement."

"That was this morning," she said. "Now they're talking about recalling their ambassador. They won't actually *do* it, it's just a threat to pressure us, but it's a real pain."

"Oh," Ray said.

"Is that all you can say?" Delores asked. "That book of yours has started—"

"The book has nothing to do with it," Ray said. "The problem is Keating."

"The problem started with *that book*." Irritably, she gestured at the typewriter. "What's this? Did your word processor break down?"

"It works fine, but not in Wideplain. I'm writing an article for a local linguistics journal."

"They won't take it," Delores said. "You're too deeply associated with this swindle."

"That's hardly fair," Gyez said.

"What's fair got to do with anything?" Delores asked. "Maybe you could translate it into English and sell it on Earth. If it's schlocky enough someone might take it."

"Charmed," I'm sure," Ray said. "Have you got a reason to stay around? You're more boring than usual tonight."

"I'd call that flouncing out in a torrid

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huff," Gyez said a moment later. "Knowing you, though, you'd have me write it as 'she left.' "

"I'm strange that way," Ray said. He looked at the typewriter, then decided against doing more work on the article. Delores was right, he thought. No kya journal would accept an article he wrote. "I should do some more work on *Roaming the Void*."

"Maybe, but not with me tonight," Gyez yawned. "It's late. Good night, Bennet."

Gyez left the room and Ray went to bed. Sleep eluded him; there was too much on his mind. Everything was going wrong. Keating had managed a perfectly legal swindle. The embassy was leaving him in the lurch. The article he was writing on Wideplain neologisms would never see publication on Kya—

And Delores had said something important—but what? It wouldn't come back to him. Something about non-publication . . .

A moment later Ray was in Gyez's room. "Gyez, where's that book you told me about? The one you couldn't get published?"

"You mean *Nightscent*?" The writer sat up and groped for his glasses. "It's in my filing cabinet. Why?"

"I want to translate it. The sooner the better."

"Why?"

"So I can save my neck," Ray said. "I think that if I can arrange an honest deal for you with another publisher we might clear up this mess."

" 'Another publisher,' "Gyez said. "What about Keating and his option?"

"I can take care of that," Ray smiled and described what he had in mind. It took him a while; Gyez's laughing snorts kept interrupting him.

There were several reporters outside the embassy, but by the time they caught wind of Ray and Gyez they were already on the grounds. Two peacekeepers hustled out of the building to intercept Ray. Delores came out a few seconds later. "What are you doing here?" she demanded.

"I want to see Nyquist," Ray said.

"He can't see you."

"Yes, he can," Gyez said. "Unless he wants me to mention Franklin to those reporters."

"Who's 'Franklin?' " Delores asked.

"Nyquist will understand," Gyez said. "We'll wait here."

The wait was not long, but it preyed on Ray's nerves. He had spent the past two weeks translating *Nightscent*, working in a near-manic frenzy, and that left him feeling drained of energy. If Nyquist should put up a fight Ray doubted he could last long.

Ray nervously fingered the computer folded into his waist pocket. At least the translation was good. The book was good. Reading it, he had found it hard to believe that Gyez was the same writer who had perpetrated *Roam to Infinity*. Translating it, he had discovered that *Nightscent* worked well in English. Waiting for Nyquist, Ray wondered if he could ever cure himself of the kya habit of starting sentences with subordinate clauses.

Delores spent a few minutes inside the building, then came to the door and motioned for Ray and Gyez to join her. Nyquist was in the lobby, and the anger on his face told Ray that he'd guessed correctly. Nyquist's involvement with

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Keating was innocent, but it wouldn't appear that way to the isolationists. The ambassador couldn't risk the outrage that exposure would bring. "What is it, Bennet?" he demanded.

"I'm here to call Earth," Ray said. "You've got the only FTL rig on Kya."

"I'd take it as a favor," Gyez said. "Hiring Bennet as my *agent*, I would—"

Nyquist groaned. "What are you going to do? Sell Keating another book?" He waved a hand in disgust. "No, I don't want to know. Go use the communicator."

The communications room lacked suitable seating for kya. This presented no problem. Gyez paced the room, filling his notepad with details on FTL telephony and human conversational traits while Ray made several calls. Asgard Books, Ray thought, that was the outfit Keating had mentioned, the one that was interested in kya science fiction. An operator at the UNESCO offices in New York gave Ray Asgard's number and the name of their senior editor.

After working his way through several layers of secretaries and aides Ray reached the editor. "Gyez," Cornelius Lancaster said musingly. "And you're his agent?"

"And his translator," Ray said. "I've been told that you're looking for kya science fiction. If that's the case, I have something to offer you."

"It's the case," Lancaster conceded. "Have you got the manuscript available on wire?"

Ray set up his computer, and a moment later Lancaster was looking at the words on his desk screen. Twice Ray saw him push a button to page the manuscript. Then he seemed to remember Ray. "I'll have to call you back," he said.

"He wants it," Gyez said, after Lancaster's image vanished.

"You think so?"

"Why else would he call back? Speaking of calls, should we call Keating now?"

"No." Ray stifled a yawn. "Let's go home. It's still illegal for me to be here, and I could use a dozen hours of sleep."

Ray got only half the sleep he had wanted, however, when his phone rang. Grumbling, he groped for the clothes he'd dumped on the floor and found the phone in a pocket. "Gagh."

"Doctor Bennet?" Delores's voice said. "Mr. Keating wants a word with you. He says it's urgent. You'll have to come back here to make the call." She sounded pleased by the inconvenience that would cause him.

Ray pulled on his clothes, roused Gyez, and went to the car. While Gyez drove, Ray thought about what to say to Keating. There were a number of possibilities, some more satisfying than others, but none of them would stop publication of *Roam to Infinity* or break Gyez's contract. . . .

Then don't break it, Ray thought with a smile.

There was a crowd of reporters in front of the embassy, and this time they could not be evaded. Their shouted questions ran together in Ray's ears, becoming a *gronk-gronk-gronk* he couldn't understand.

"Please, please!" Gyez said loudly. "Working for me, it is legal for Bennet to enter the embassy—" Ray hoped that was true "—and we have further business to transact."

"With those thief-humans?"

"We're about to straighten that out,"

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Ray said. "We'll have good news for you in a while."

"I hope you're right," Gyez said, after they had squeezed past the reporters. " 'Writer and alien stopped by disgruntled reporters'—that's what the leadlines will say if you're wrong."

"I have a plan," Ray say. They went into the embassy. Delores was there. "Where's Nyquist?" Ray asked.

"Mr. Nyquist isn't available," she said frostily.

"Tell him he is," Ray said. "I want him and you to listen in when I call Keating. I'm going to clean his clock and I'll need witnesses. I'll be in the comm room." He breezed past her and led Gyez to the comm room.

Ray called Keating's office. As he finished punching in the numbers he noticed a button marked *record*. He pushed it just before Keating answered the phone.

Keating's image glowered at him. "Bennet, you're a dead man. I just heard about what you did. Selling one of Gyez's books to Asgard—damn it, I have an *exclusive* option."

"Only on his published works," Ray said. "*Nightscent* has never been published. Not on Kya, not on Earth, nowhere. You don't have an option on it. Read the contract."

Sounds of fury and destruction proceeded from the phone. "You can't use some penny-ante loophole!" were the first coherent words Ray heard.

"It's no loophole. But there *is* a loophole that Gyez can use." Ray smiled. "He has the right to reject any and all translators. He's going to do that if you don't renegotiate his contract. Legally you won't be able to publish anything else of his. In fact, since he didn't approve the rough translation I sent you, you're on shaky legal grounds with this publication—"

"You squamiferous teratism!" Keating shouted. "You can't get away with this!"

"You had a verbal contract with Gyez," Ray said impassively.

"I know. So what? A verbal contract doesn't count."

Ray smiled. "It does on Kya."

"I'm not on Kya," Keating said smugly. "Their laws don't apply here."

"Why don't we let a judge decide that?" Ray said. When Keating smirked Ray went on. "The UN will pay Gyez's court costs. He can hire the best lawyers and keep you in court for years. That will cost you more than you make from his book, even if you win."

"You're bluffing," Keating said.

"Maybe, but think of what you'll lose if I'm not."

Keating glared at Ray, but there was calculation in his eyes. Ray could see the publisher compute profits and losses before he spoke again. "What does Gyez want?"

"First, he wants six percent royalties on *Roam to Infinity*."

Keating growled before speaking, "All right."

"Next, he expects a ten thousand IMU advance on the next book, with six percent royalties—"

"All right."

"Plus you hold up publication of *Roam to Infinity* until we turn in the final translation. *And* you publish the final translation," Ray added.

"We've already started printing," Keating said. "Do you know what that will cost?"

"No," Ray said, "but if the kya ov-

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ergovernment extradites you for a long trial—and the UN would undoubtedly let them—"

Keating cursed. "It's a deal, you thief. I'll have a contract drawn up." The connection broke.

Ray smiled and switched off the recorder. While Earth had its laws, nothing on Kya prohibited recording a private conversation without notifying the involved parties, no doubt because the kya had yet to invent the tape recorder. If Keating had second thoughts the recording would make a fine verbal contract in any kya court, just as Nyquist and Delores would make impeccable witnesses on Earth.

Gyez had been listening with silent interest. While his English left much to be desired he had picked up certain points. "He won't publish his version of *Roam*?"

"No. We'll have to finish our translation, but that's no trouble."

"So that problem is done." Gyez sniffed pleasantly. "And—ten thousand *I-am-yous?* Is that money?"

"International Monetary Units," Ray said. "UN currency. It's a lot of money."

"That's the kind I like." Gyez snorted. "And I was only going to tell Keating to shake hands with himself!"

"I figured making him pay would be better revenge," Ray said. "I sure as hell hope this means the trouble is over."

"I think it does," Gyez said. "The problem has been Keating. We've erased his crime, turned his own tricks against him and made him run straight. And we did it together. Cooperation like that will leave the isolationists sniffing their own breath!"

"I suppose so," Ray said. Teamwork, he thought. That was important to the kya. "We should tell the reporters now, get the good news out in the open—"

The communicator beeped. "There's a call for Dr. Bennet," a cybernetic voice said, "from a Cornelius Lancaster."

"Put him on, please." Ray covered the microphone with a hand. "Lancaster," he told Gyez. "Looks like this is your big day."

The connection cleared and Lancaster spoke. "Bennet?"

"Right here."

"I just finished reading *Nightscent*. Why are you offering it as science fiction?"

"Well—" Ray was taken back. "It's about aliens and other worlds—"

"Since when is that SF?" Lancaster asked. "Look, Bennet, I want it, but I'll have to publish it as real fiction."

Ray sighed. "That's fine here."

"Good. I'm considering a forty thousand IMU advance, and six percent royalties for the hardcover edition. You'll get eight percent on the paperback and digital editions, fifty percent on any merchandising and performing-arts adaptations. How does that sound?"

"That sounds very good." I should have gouged Keating for more, Ray thought. He smiled and decided he liked being an agent.

"Then we have a deal. I'll have my legal department send you a contract. Good bye."

Not bad, Ray thought as Gyez left to talk to the reporters. Then he realized that, as Gyez's agent, he would get ten percent of the deals he had just made. Not bad at all. ■

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the reference library

By Tom Easton

The Quiet Pools, Michael P. Kube-McDowell, Ace, $17.95, 373 pp.
Golden Fleece, Robert J. Sawyer, Questar, $4.95, 175 pp.
The Hemingway Hoax, Joe Haldeman, Morrow. $16.95, 155 pp.
Voyage to the Red Planet, Terry Bisson, Morrow, $16.95, 221 pp.
A Key for the Nonesuch, Geary Gravel, Balantine/Del Rey, $3.95, 229 pp.
The Abraxas Marvel Circus Stephen Leigh, ROC, $3.95, 256 pp.
Bully! Mike Resnick, Pulphouse Publishing (Box 1227, Eugene, OR 97440), $10 trade paper, ? pp.
The Year's Best Science Fiction, Seventh Annual Collection, Gardner Dozois, ed., St. Martin's, $24.95, 624 pp.
Full Spectrum 2, Lou Aronica, Shawna McCarthy, Amy Stout, and Patrick Lo-Brutto, eds., Bantam, $4.95, 548 pp.
Books on Disk

Some errors are so subtle that few readers notice them and even fewer feel that they matter. They may even be so subtle that reviewers who call attention to them make asses of themselves. In fact, they may not be errors!

For a case in point, consider Michael P. Kube-McDowell's **The Quiet Pools.** This is an ambitious novel with many fine elements. It centers on the effort to build *Memphis,* the second of a series of huge starships, generation ships, that will take Earth's seed to the stars. Against the emigrants of the Diaspora Project stand the Homeworlders, led by the pseudonymous Jeremiah, who believe that Earth needs all its resources and people, and are willing to terrorize and sabotage and kill to prevent the *Memphis*'s departure. Yet the Diasporans know that there is a deep-down human drive that takes us onward and upward. This drive is written in the genes, where it can be read and used to select colonists for the *Memphis.*

And here's the error, if indeed it is

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an error. Genes are DNA, deoxyribonucleic acid, whose component nucleotide bases are adenine, thymine, cytosine, and guanine: A, T, C, and G. Kube-McDowell uses genetic code words as epigraphs for his chapters, and those code words are GAU, GUA, UAU, and so on. The U stands for uracil, a nucleotide base found not in DNA, but in RNA. So did the author take his code words from a textbook table of the "genetic code"? Such tables are generally phrased in terms of RNA, which serves as an intermediate between DNA and the final protein product. You have to translate the code words to get their DNA equivalents, and Kube-McDowell didn't do that.

How malicious can an author be? Consider that RNA—specifically *messenger* RNA—is the intermediate between gene and protein. Consider that *messenger*. And consider the Diaspora Project, the emigrants, the generation starships, all as another kind of messenger between past and future.

The story itself begins with an act of terrorism. It then steps aside to show us Christopher McCutcheon, a Diaspora librarian, and the problems of his three-way marriage. His father summons him for a reunion. There is more Homeworlder terrorism. The focus shifts to the Diaspora security chief, and we have the basic shape of the story: the fight to escape from mud-bound, reactionary, shortsighted viciousness, a struggle familiar to all readers of science fiction. But what is McCutcheon doing there? Kube-McDowell treats him as central, and he is obviously a man of very peripheral importance to the scheme of things, no matter how intriguing the insights he allows us into the nature of the book's society. Something else has to be going on, and the experienced reader very quickly twigs to what it is: McCutcheon has something to do with Jeremiah, and his personal problems, psychoanalytically linked to his childhood, illuminate the head terrorist's motivations.

I won't spell it out any further. Suffice it to say that, for me, the story's greatest defect was its predictability. McCutcheon's struggle to overcome his problems, grow up, and separate himself from his childhood traumas, while interesting and in the end relevant enough, never managed to impress me as sufficiently more than a side issue to justify the time and pages the author devoted to it. Nor did it help that the succession of terrorist crises seemed designed only to delay the finale, add pages, and make me say, "Come on! Enough stalling! Get to the point!"

Golden Fleece is the first novel by Robert J. Sawyer, and though it's not entirely successful, it's not bad either. The tale is set on a large "starcology" or space-going arcology, the Bussard ramjet *Argo*. It is carrying a little over 10,000 people on a mission to explore Colchis, a life-bearing world orbiting the star Eta Cephei. It is run by Jason, a tenth-generation computer which is immediately revealed as rather more intelligent than its designers and users suspect: Chapter One shows Jason chasing one of the crew members, astrophysicist Diana Chandler, into a trap and killing her.

Is Jason mad? Has the computer gone berserk? Or does it have some rational agenda? The reader soon learns that not long before the *Argo* left Earth, a message was received from the stars. It was not announced to the public for fear that the furor would abort *Argo*'s mission. There is a hint that Diana had figured out that the *Argo* was not on its proper course. And when Diana's ex-husband,

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Aaron, notices that an antique watch is not keeping the same time as the ship's computer-controlled clocks, the reader begins to wonder whether Jason is concealing a change in the mission plan. My own guess, at about page 40, was that the ship was on its way to the source of the alien message.

Happily, I was wrong. Yet it takes a while to learn the truth, while Aaron grows increasingly suspicious and catches on to the computer's plot, the computer builds a massive simulation of Aaron's brain in an effort to anticipate what he will do next, some of the crew are agitating to return to Earth, the four-armed engineer is building nuclear bombs in his shop, and . . .

It sounds good, doesn't it? In many ways, it is. The writing is smooth and the reading effortless. The characters —even Jason—evoke your sympathy. The problem is that the whole story is told from the computer's point of view, and to do so Sawyer must give Jason almost superhuman capabilities. It must be able to interpret various tics of face and figure and heartbeat to interpret what is going on in the human characters' heads, and Sawyer is not convincing. Jason must also be able to succeed with effortless ease in something that has stumped generations of humans and computers—the simulation of a mind. This too does not convince. And if we assume that the artificially intelligent computer is really as potent as Sawyer presents it, the true reason for the computer's subterfuges becomes virtually impossible to believe. Just as bad, the final victory of the humans is far too easy.

Sawyer has tackled an ambitious task in his first novel, and he handles it pretty well. If he has failed, he has nevertheless failed in an interesting way. His story may not have convinced me this time out, but *he* has convinced me that he's worth watching. I'm looking forward to what he does next.

Not being a Hemingway expert, nor even a buff, I can't vouch for this, but according to Joe Haldeman, in 1921 Hemingway summoned his wife to join him in Switzerland. She packed all his manuscripts—carbons and all—into a box and boarded the train in Paris. Almost immediately, someone stole the box, and the world lost a trove of early Hemingway forevermore.

That this situation was made to order for a scam emerges as soon as John Baird, a Hemingway scholar, reveals his fascination with the loss of the manuscripts to Key West con-man Sylvester Castlemaine. All that's needed is the right antique typewriter, the right paper, and someone who can convincingly simulate Hemingway's early style. Castle pushes. Baird hems a few haws, admits that, yes, he *could* write the stories, says that, um, we have to do this in a *respectable* way, don't you know, and lo! We have the birth of **The Hemingway Hoax.**

What makes it the "short comic novel of existential terror" the novel's subtitle calls it? It's not the closeness of Haldeman's style to Hemingway's, rooted in obvious love and admiration. Rather, the author introduces a strange being whose job it is to excise those individuals whose activities threaten the integrity of the sheaf of parallel worlds that includes our reality. For some reason, "he" thinks Baird (but not Castle) is a suitable target for his affections. But when he offs the poor fellow, he finds that Baird has not vanished from all Earths as is only right, proper, and normal. He is gone from one only.

Therefore, he is not gone, right? Haldeman moves one world over in the

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sheaf and shows us Baird awakening with the consciousness of two worlds, two identities, merging within his skull. Castle is still around, though he has changed a bit, as have Baird and his wife. The plot is still on, too. Our supradimensional referee must therefore say, "Tchah! Missed!" and come back for another shot.

The tale jumps tracks again. In due time, the warden offers Baird a deal: "I'll pop you back in time to see for yourself what happened in 1921. And then you'll stop with the plot, right?" Baird agrees, and . . .

I'll say no more, except that this one is clever, absurd, and delicious. Don't miss.

Terry Bisson has done some marvelous work (remember *Talking Man* and *Fire on the Mountain*?). I therefore expected more marvels when I opened **Voyage to the Red Planet.** Did I get them? Well, in a way, but . . .

Bisson gives us a satirical romp through a future when the public sector has gone totally private, to the point where governments are corporate subsidiaries, national parks are owned by Disney-Gerber, and international bankruptcy has left the *Mary Poppins*, the ship once intended for a joint US-USSR Mars mission, stranded in orbit. "Now," he says, "look at Hollywood, the only outfit with the bucks or the motivation to go to Mars. Watch them recruit retired astronauts and cosmonauts. See the hereditary Movie Stars, the dwarf director/cameraman, the stowaway girl, the cat smuggled aboard by the medic. Here's how they'll pass the time on the voyage, in sleep triggered by an extract of hibernating bear, and whoops! The female lead won't wake up! And she's growing fur! But maybe we can use the stowaway."

They land successfully on Mars, where they power their equipment with as novel a gimmick as I have ever heard of: They record digitized sunlight on compact disks and play it back to illuminate photovoltaic cells. You don't like that? Don't fret. In his up-front acknowledgments, Bisson thanks several who "helped the author avoid many errors and grotesqueries. Those that remain in the book are the ones he couldn't resist." So. A joke. So laugh. And then go on to the semi-living clay, the heavy oxygen, the ruins, the fuel shortage, the . . .

There's plenty, and it's all quite enjoyable. On the other hand, there is a very real hazard that the book could confuse those who lack some familiarity with basic science even more utterly than can a supermarket tabloid.

For quite a different look at Mars and expeditions thereto, consider Harry Turtledove's latest novel, **A World of Difference.** This one hinges on a remarkably bold version of SF's basic game of "What if . . ." Turtledove fires his opening shot in his "Author's Note," where he says, "Mars is boring. Turns out it's too damn small. But what if it weren't . . ."

That said, he promptly replaces Mars with Minerva, roughly Earth-sized, clearly life-bearing even to Earth's astronomers, and possessed of a far more magnetic attraction than ever the Red Planet was. That attraction gained considerably when a 1976 Viking lander was beaten to death by a stick-wielding native. The natural consequence was a joint Soviet-American expedition —separate crews, separate landers, separate landing sites, but definitely simultaneous, sharing in risk, in availability for help, and in information gained. Except that the Americans, thanks to

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last-minute recalculations, knew the Viking site was on the *other* side of a vast gorge and landed well out of Soviet reach.

The natives are shaped something like human-sized sea cucumbers with starfish arms on both ends. Six arms. Six legs. Six eyestalks. Radial symmetry. They reproduce sexually, with six young—one male, five female—growing within cavities in the female's trunk, each one connected orally to a major blood vessel. At birth, mama invariably bleeds to death. No second shots. Females are cloistered at birth, they are kept ignorant, they mate once while still young, and they are gone. "Who ever heard of an old mate?"

However unlikely the biology of this situation,[1] it is quite a metaphor for the feminists among us. Not surprisingly, Turtledove spends some attention on finding a way to help the females survive the rigors of childbirth and points to a future of extensive social change. Yet where someone else might have focused a whole novel on this, for Turtledove it is only a side note.

Center stage is occupied by politics. There are two groups of natives on the two sides of the gorge. The group visited by the American crew is feudal but relatively broad-minded. That visited by the Soviets is capitalist and warlike, with a definite craving for feudal lebensraum. Will the humans help each other or their "client states"? Will the natives let them make up their own minds? Will war on Minerva lead to war on Earth? Who will die? Who will not?

The prose is straightforward and uncomplicated. The human characters smell of the prop chest, though the complexity of their relationships saves them from the accusation of being no more than cardboard. Still, the natives, especially the feudal chieftain's favorite mate, feel more alive, more original. Turtledove has given them unique life-problems, with thoughts and feelings to match. I found myself much more interested in the plight of the females and the effort to save them than in the political maneuverings, which felt exceedingly familiar. For many readers, however, those maneuverings will be the meat of the story. Turtledove has done a nifty bit of world-building, found in his world a number of problems that feel quite real, and told an interesting story about the solutions the characters, human and alien, must find.

Yet I do find myself hoping that he will write a sequel centered on the social impact of females who have escaped the restraints of their biology.

Geary Gravel's **A Key for the Nonesuch** is an entertaining adventure that carries no freight at all and will let you pass quite a pleasant evening. It opens when fix-it man and would-be novelist Howard Bell swipes the key to an executive washroom. When he uses it, he finds himself propelled into a desert world in which fierce warriors of numerous species fight deadly war-games for the pleasure of the Keyholders. The Keyholders, it seems, periodically steal groups from various inhabited worlds and set them up on new worlds, or Holdings, to breed gladiators. The gladiators play their games on the Worlds of the Fade, so named because the Keyholders can cause one world to fade into another, thus changing the stage setting.

Because Howard has an eye for pattern, he is a good fix-it man. He also catches on fast, kills enemies, makes friends, finds possible romance, and learns how to use his Key. To keep the

[1]Darwinian selection seems very likely to guarantee the development of sphincters on the blood vessels.

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tale moving. Gravel throws peril upon peril at his hero, who surmounts them all with the greatest of ease, even though he does pick up a bruise or two in the process. By the end of the tale, the romance has become real, Howard is generally recognized as a true Hero, and it looks like his destiny is to wage war against the Keyholders and, with the aid of a mysterious force or two he has encountered, free their gladiators.

I wouldn't be surprised to hear there's a sequel or two in the works. Nor, given the amount of interest in role-playing games, would I be surprised to hear that Gravel was inspired by such games, or to run across a game set in Gravel's universe. It's made to order for such a thing.

If you enjoy—or don't mind—an erotic kick to your fantasy, try Stephen Leigh's **The Abraxas Marvel Circus.** It's a fairly routine story with some nice touches[2] and a point that says something about what it is that makes life worth living.

The tale opens when Dirk, an ex-history prof turned wannabe rock star, spots Angela in the audience, is instantly infatuated, and lets her haul him off to an ancient house that just may be haunted. Angela is searching for the notebook of the late Carlos Theopelli, a crank who claimed he had figured the math to calculate the future. But it isn't there. Dirk and Angela console themselves accordingly.

Meanwhile, elsewhere, the hermaphroditic Joan the Flower Man is stealing funeral flowers, wrapping them in pages torn from Theopelli's notebook, peddling the bouquets to passersby, and being befriended by Ecclesiastes Mitsumishi, owner of the Corpus Delicti, the Remains to Be Seen, The Body Shoppe, The Stiff's Upper Lip, and other strangely named and not so strangely short-lived funeral homes. The dwarf Mage Mundo is gibbering at Theopelli's one-time assistant, who had had the notebook until Joan snaffled it. And Abel Henderson, one-time carnie master, one-time pimp for Joan and other freaks, a nasty fellow turned TV evangelist, has a berserk prophet who has told him of the notebook, the Mage, the Whore, and more.

As things come together, the reader learns what he or she suspected from near the start: Angela and Mundo have come from parallel worlds. They want the notebook in order to save their worlds from catastrophe. But Theopelli—once Mundo raises him from the dead—has other ideas, for he is most concerned about the way modern modes of thought have closed off the mysteries of the universe. He wants to restore the marvels.

Does he succeed? Read, and see. And then ask yourself whether Leigh copped out. After all, he peopled his tale with characters as bizarre as Joan and Ecclesiastes, for two. In a world that was not hung up on conventional fantasy images, they would be marvels enough to substitute for any number of unicorns.

The latest of Pulphouse's Axolotl Press novellas, available not only as a $10 trade papberback but also in $35 autographed, cloth-bound, and $65 autographed, leather-bound deluxe editions; is Mike Resnick's **Bully!** Mike lets his fascination with things African show once more as he gives us the moment when Teddy Roosevelt, at the end of his 1910 safari, was invited by white elephant poachers to help them take over central Africa. In history, he turned the offer down. In Mike's hands, he does

[2]Take that any way you like.

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not. Indeed, full of optimistic determination, he vows to civilize Africa, using the American experience as a rough draft.

At this point in history, Mike's central point, that American ideals do not necessarily export well to other lands and peoples, does not seem terribly profound. But he does make that point well. By the time you have finished *Bully!* you will be well aware that Roosevelt's missionary zeal is as colonialist as the elephant hunters' looting. The Africans have other priorities. They are not inferior, but they are definitely different, and they have little use for democracy, freedom and industrialization.

You may also have some sense of futility. Mike says as well that Africa has a way of swallowing the grandest of dreams while leaving barely a ripple on the world beyond. That is, Africa is untouched by Roosevelt, while Roosevelt, even though his life is changed for a while, winds up pretty much where our history books put him. And the world beyond goes on as always.

The seventh of Gardner Dozois' **Year's Best Science Fiction** volumes is now available. Unfortunately, I can't say much about it, for the bound galleys I have in front of me lack the introduction, the 1989 summation, the list of honorable mentions, and even the story notes we're used to seeing. The 25 stories themselves are there, though, and they are by Judith Moffett, Charles Sheffield, Mike Resnick, Gregory Benford, Connie Willis, Kathe Koja, Steven Popkes, Robert Silverberg (twice), William King, Bruce Sterling, Lucius Shepard, Nancy Kress, S. P. Somtow, Alexander Jablokov, Michael Swanwick, Megan Lindholm, Alan Brennert, Neal Barrett, Jr., Robert Sampson, John Varley, Janet Kagan, Brian Stableford, Avram Davidson, and John Crowley. Among the contents are one of the six Nebula-nominated short stories, four of six novelettes, and two of six novellas.

As usual, a fine package. You don't need me to say you can trust Gardner to deliver the missing pieces before the book hits the bookstores.

Full Spectrum 2, edited by Lou Aronica, Shawna McCarthy, Amy Stout, and Patrick LoBrutto, is now out, and it looks good. It contains 27 stories by established professionals Edward Bryant, Jack McDevitt, James Sallis, Vonda N. McIntyre, Karen Haber, David Brin, Mike McQuay, Steven Sprull, Robert Sampson, Michaela Roessner, Patricia A. McKillip, Steven Popkes, James Kallis, Greg Bear, Alan Rodgers, Michael Swanwick, and Kim Stanley Robinson, as well as by a number of relative newcomers to the field (David Ira Cleary, Guy Partington Terry, Elizabeth Hand, Carolyn Ives Gilman, Joseph Gangemi, Marcos Donnelly, Michael Kallenberger, Deborah Million, Charles Oberndorf, and Lori Ann White).

BOOKS ON DISK

Steve Miller has come up with just the right name for the publication of books on disk, which seems to be happening more and more. He thinks it should be called "disk-top publishing." He's interested because he has just begun to advertise his own "disk-top" operation, "BPLAN Virtuals." He's actively looking for titles and expects to have well over a dozen ready to ship by the time this plug sees print. He's using Ted Husted's IRIS. For information, write to Steve Miller, Box 338, Waterville, ME 04901.

I've seen no product, but the latest *SFWA Bulletin* did carry a brief mention

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of Joan Szechtman, Publisher, Soft Press, 917 Ward Lane, Cheshire, CT 06410. She is apparently "attempting to market novels 'on floppy disk only, for IBM PC/XT/AT.' " Write for information.

Here are a couple of brief updates: Roleigh Martin's *ShareDebate International* (Applied Foresight, Inc., P. O. Box 20607, Bloomington, IN 55420) costs $5 for a single issue but can be downloaded free from three different national bulletin boards. On BIX, get DBATE001.EXE (area IBM.UTILS). on GENIE, get DBATE001.ZIP (file 17976 in Lib.3 in IBM PC S/W Lib). On Compuserve, get DBATE1.EXE (in Lib.6 in SCI-FI Forum). You can also obtain it from many shareware distributors. A printed version of the first issue is available for $15. Greater on-screen sophistication of format is planned. And a Macintosh version is under development.

John Galuszka, Publisher, Serendipity Systems (P.O. Box 104, San Simeon, CA 93452), writes that he not only publishes on-disk books but also sells, for $25, PC-BOOK, a program for use by writers who would like to do their own on-disk publishing; it sounds similar to Ted Husted's cheaper IRIS and PRISM. In addition, he "is sponsoring the BOOKWARE library system for the distribution of electronic books" from various sources; it will function rather like a shareware library. Write for information.

Finally, Galuszka also sent along a copy of his SF title, John Peter's *Baby April*. It's the highly derivative tale of a man who, while fishing in the woods, finds a strange monolith. Rain threatens, he steps into the doorway in its side, and he is the captive of a strange intelligence. Peter writes with such excruciating attention to detail that even though I think "disk-top publishing" holds great promise, I can hardly hold him up as a shining example. Not recommended. ■

●Knowledge is the only instrument of production that is not subject to diminishing returns.

J.M. Clark

●POWER TOOLS (*n.*)—(1) When used by me, a blessing of civilization. (2) When used by my neighbor, a curse of civilization.

from KELVIN THROOP'S LEXICON OF POPULAR PARLANCE

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brass tacks

Dear Dr. Schmidt:

I enjoyed your recent excursions into fictional world creation (Gillette—July, '89, and Barnes—March, '90 issues). But one thing which neither of them touched on in any depth was software assistance in the design process. I remember a program by Stephen Kimmel, in June, '83, in the now-defunct *Creative Computing*, called "World Builder." It was written in Microsoft BASIC for the australopithecine Radio Shack TRS-80 Model I, and dealt with the "physics and astronomy" (to quote the lead-in to Barnes) of the process.

I adapted it for my Neanderthal Heathkit CP/M-based H-90 system. It includes facilities to select 1 of 34 known stars or "design" your own, create a planetary system, add up to 10 satellites per planet, and draw some conclusions on indigenous life and human habitability. Of course, the assumptions it uses are simple, but it could be used as a base for more sophisticated effort. Even so, it is quite interesting to tinker with.

If any of your readers are interested, I would be happy to copy it for them, along with a short ASCII documentation file. I just ask that requests include a *formatted* disk and postage-prepaid return mailer. I can read/write a host of CP/M (though the Western Digital controller chip in my machine limits a few, such as Kaypro, to single-sided) and PC-XT formats. Sorry, but I can't handle 3-1/2-in. If in doubt, write me.

KIRK L. THOMPSON
Editor, *The Staunch 8/89'er* Newsletter
#6 West Branch Mob Hom Vil
West Branch, IA 52358

Dear Mr. Schmidt:

I have been looking forward to John Barnes's article "How to Build a Future," since he first mentioned it several

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months ago at Noreascon. I was sure I would find it interesting because I have been trying to address many of the same questions he tackles on interstellar societies and their construction. I was delighted to learn that I've been doing it all wrong. At least I figure I must be wrong, because I'm afraid I didn't use his methods and wound up with entirely different results.

Seriously though, I think the article is excellent in its own right, although I question some of the assumptions that Mr. Barnes makes in his extrapolations.

First of all, he postulates a 23rd-century spacefaring society with a billion members living offplanet. I am not sure that such a society would be as parsimonious in its spending on interstellar colonization as the US Congress is on the current NASA effort. I think it would engender at least as much support as recent defense budgets, which have been supported more out of irrational and bizarre fantasies than out of serious considerations of national interest.

Second, I would question the lack of incremental advances in the technology of interstellar flight over the course of time. A high level of "magic" technology should render the system he envisions obsolete in very short order, and open the way to faster and more efficient travel.

Third, I wonder if 96 people is a realistic size for a colony? While the number is constrained by the technology he assumes, I think not. Early colonies in North America were similar in size, but they were launched by a nation of 3 million souls, not 20 billion, and had fairly close contact with their sponsors. A proportionately larger effort for the 23rd century should number in the tens of thousands, especially if it is going to be light years from home.

Fourth, while the prospects for interstellar trade are indeed severely restricted, I would add some items to Mr. Barnes's list. His "Grad Students from the Stars" would be joined by technical experts with skills, training, and experience that would be lacking in smaller and younger colonies. And I question the altruism involved in the open broadcast of technical information that is currently protected by copyrights and patents. And, if the trade in bodies and proprietary information is to be rewarded, colonies must swap money of some sort.

Fifth, and this underlies all the other quibbles I have, the extrapolations Mr. Barnes makes about the next few hundred years are all based on the limited experience of the 20th century. Great powers at war are essentially a recent phenomenon, as are huge economic dislocations. There is no particular reason to believe that the nation-state will survive the political changes of the next century, and I am not sure that the capitalist business cycles that Mr. Barnes is using will survive the integration of a global economy where—outside the US—government planning plays an important role.

This last point cuts to the heart of my general disagreement with the otherwise admirable job that he has done, and that is that his qualitative work has to be leavened with some qualitative analysis. Economics and political science are very good ground for number crunching, but I fear Mr. Barnes neglects historical analysis, which can be more ambiguous and less accessible to numerical evaluation.

But then, that is not what he set out to do, and I do not find fault with him for doing something else.

DANIEL HATCH

The author replies. . . . .

Looks to me like Mr. Hatch has done

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a first-rate job of worldbuilding. Since the small colony size seems to be an issue, let me add that I simply wanted to make sure those colonies were thoroughly isolated, which meant I wanted star travel to stay expensive and difficult . . . and obviously the technology available for interstellar travel has a lot to do with what you can send. But Mr. Hatch's approach, in which colonies would communicate more with each other and with Earth, seems to me to be self-consistent, and to work fine for his story, and that, after all, is the point of all of this.

The notion of actually being able to reduce population by emigration is fascinating—difficult to support in any historical context I can think of, but as Mr. Hatch shows, not impossible. Seems to me like there's a good novel in the implications demographically for the stay-at-homes, as well.

I'm not much of a fan of the Grand Theories of civilization (Toynbee, Spengler, etc.) because of the tendency for the pattern to disappear the more we see the detail. That is, the hypothetical 5th-grade-history-book versions of the rise and fall of several civilizations will look a lot more alike than the senior-seminar-in-history versions. This, however, is a matter of taste—as are virtually all of my differences with Mr. Hatch. He clearly plays the game well, and I look forward to reading his work.

JOHN BARNES

Dear Dr. Schmidt,

This letter is about the article "How to Build a Future" by John Barnes, which treats two long standing interests of mine—science fiction and dynamic modeling. My file of *Astounding* goes back to 1948 and my interest in dynamic modeling some 20 years. The point of the letter though, is that while the method of using a spread sheet to build a model works, there are several programs that run on desk-top computers that are easier and do a much better job. My favorite is a program called STELLA which runs on an Apple Macintosh. STELLA is produced by High Performance Systems, Inc.; 13 Dartmouth College Highway; Lyme, NH 03768.

A projection of the future different from Mr. Barnes's but also based on a dynamic model is contained in *The Limits to Growth*, by Donella H. Meadows et al., ISBN 0-87663-165-0, 1972.

Incidentally, Professor Jay Forester of MIT, a leading figure in system dynamics—the science of applying dynamic models—and who built the precursor model to that in *The Limits to Growth*, is working on an economic model which incorporates, among other things, the Kondratieff Cycle.

For more information on current thinking about dynamic modeling, I refer Mr. Barnes to *Systems Dynamics Review*, the journal of The System Dynamics Society, System Dynamics Group, M.I.T. E40-294, Cambridge, MA 02139.

MAHLON EASTERLING
4702 Old Chapel Hill Road
Durham, NC 27707

The author replies . . .

My period of active research work in dynamic modeling was 1980-81; by that time, Forester, *The Limits to Growth*, and the whole "System Dynamics" cult had been largely bypassed by developments in the field. When I reviewed Stella for a couple of computer publications in 1988, I was surprised to discover that much of the same old nonsense had actually been built into marketed software.

There are uses for Stella, and I do use it myself because of its unparalleled capability for realtime phase diagram-

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ming. But I emphatically do not recommend it to beginners, because the program and the manual contains a whole set of hidden defaults and assumptions which tightly constricts the possible outcomes of a given model.

To cite a few examples, sequencing execution is not meaningfully user-modifiable; after more than a decade of work in chaos theory, the manual still promotes "robustness" as a criterion for a good model; elaborate coding (and often the introduction of fictitious variables) is required to specify conservative, nonconservative, and semiconservative flow; true system-state phase transitions are extremely difficult to do, where they are relatively simple in a spreadsheet.

Moreover, there is a specific agenda in the approach to the world that Stella embodies. The principles embraced by the "System Dynamics" people essentially endorse the smooth sigmoid of yeast growing in a Thermos bottle as the appropriate way to see the universe; the noise, sensitive dependence on initial conditions, abrupt transitions, and unexpected shifts in conditions found in the real world are ruled out of bounds. It does not seem accidental to me that an organization whose original funding came heavily from foundations supported by the wealthiest people on the planet should be promoting a philosophy of modeling in which change is generally seen as bad, and rises in the standard of living as disasters to be prevented if at all possible, and at the least controlled sharply. The money was put up by people who despise the rest of the human race and who live by exploiting it; is it any wonder that the people they hired have devised a system for proving that nothing can or should be done to change the present state of affairs?

JOHN BARNES

Dear Mr. G. Harry Stine:

I loved your Three Dolphin Club column in the April issue. It very much widens my image of your character (all for the better). This letter is in response to your postscript, however.

I've been a computer hobbyist for just over 25 years, now, and a full-time professional for over 10. One of my most important professional edges, and best jokes, is that, "I'm bilingual. In addition to computer, I speak English," so I had vivid images of clashing viewpoints and priorities from your discussion of Adventures in Word Processing and User Interfaces.

You were on one edge of a topic where my relatively long perspective gives me an opinion which seems to be fairly rare. Certainly computers are converging on a universal basic 'user interface,' just as automobiles did, but *we don't know how far along the way we are*. Voice recognition, for example, will be coming online in microcomputers through the first half of the Nineties (look at the efficiency of existing techniques and factor in a 50% drop in raw machine power every two years, and it's a sure thing). 'Point and click,' the current Hot Thing could, perhaps, fall back down near Command Line (a relic of TTYs).

Only after things settle down will we be able to look back and see how far along the way today's styles and techniques were.

NEIL REST

Chicago, IL

The author replies. . . .

Dear Neil:

I'm glad you liked the Three Dolphin Club. I wrote it with tongue in both cheeks, of course. I can do that because I have a forked tongue. . . .

What a neat concept you have in the convergence of human-machine inter-

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faces! May I steal it? I agree with you and hasten to point out that we don't know how far along the way we are in any human-machine interface. We can *always* make improvements. I'm not at all certain that even within ourselves we have achieved a proper mind-body interface which is analogous to the human-machine interface. Getting the input peripheral to properly talk to the output peripheral is a common problem in all machines, including the human machine.

There, I've gone and given away a perfectly good Alternate View subject!

In all areas of technology (technology know-how), it's always fun as well as interesting to look back and see how far we've come. And then to try to guess on that basis what and how soon the next step will be. Which reminds me of the saying, "History repeats itself because we didn't learn the first time."

G. HARRY STINE

Dear Dr. Schmidt:

Re: the lively discussion on "democracy" (Brass Tacks, April); you rightly pointed out that most people who discuss the term can't agree on what it means. I wonder how many ever came across George Orwell's comment (in "Politics and the English Language") on that word: " . . . not only is there no agreed definition, but the attempt to make one is resisted from all sides. It is almost universally felt that when we call a country democratic we are praising it; consequently the defenders of every kind of regime claim that it is a democracy, and fear that they might have to stop using the word if it were tied down to any one meaning." No wonder we find confusion.

I was surprised that nobody came forward with an idea that Nevil Shute presented in one of his stories. Everybody got one, basic vote. But individuals could add to their voting power by certain attainments: a prescribed level of education; military service; residence abroad, etc. A single person could effectively cast up to six votes in this way. There was a seventh vote, bestowed only by the Queen, for some exceptional service or contribution to society.

Nice idea. But in these times it wouldn't stand a chance; it would be considered elitist. Politicians would water down the requirements as fast as you could say, "grade inflation." Perhaps one thing this country suffers from is an excess of egalitarianism.

CHARLES H. CHANDLER

Malden, MA

■

●Visionary people are visionary partly because of the very great many things they don't see.

Berkeley Rice

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IT'S ANLAB TIME AGAIN— PLEASE VOTE!

Mid-December is our last issue for 1990, and (as always at this time of year) we'd very much like you to let us know how we're doing, via The Analytical Laboratory. Not only will your votes provide tangible rewards for your favorite authors and cover artist, but what we know about your likes and dislikes will influence our selections of what to offer you in the future. Your vote is important! Here's how to cast it:

Look over all your copies of *Analog* dated 1990, or refer to the annual index which will appear in our January 1991 issue.* Pick your *three* favorites in each of the following categories: novella or novelette (a single category, for AnLab purposes), short story, science fact article, and cover. List your choices in order of preference (your favorite in each category is #1) on the ballot below, and mail it in. (The ballot is intended to make it easier for you to vote, but if you don't want to cut it out, feel free to copy it.) We'll tabulate the votes and let you know how they came out a few issues hence.

Please send your votes to: AnLab, *Analog*, 380 Lexington Avenue, New York, NY 10168-0035. To be sure your vote counts, please mail it in time to reach us by February 1, 1991.

Thank you very much!

—The Editor

*Please note one correction: "Green Cheese," by Grey Rollins, was incorrectly listed as a short story in the April Table of Contents. It is actually a novelette.

NOVELLAS & NOVELETTES

1. _____

2. _____

3. _____

SCIENCE FACT

1. _____

2. _____

3. _____

SHORT STORIES

1. _____

2. _____

3. _____

COVER

1. _____

2. _____

3. _____

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a calendar of analog upcoming events

7-9 December
SMOFCON 7 (SF convention-runners convention) at Fort Lauderdale Airport Hilton, Fort Lauderdale, Fla. Registration—$40 until 30 September, $45 until 15 November. Info: SFSFS Secretary, Box 70143, Fort Lauderdale FL 33307.

14-16 December
CONINE 2 (Oxford SF conference) at Oxford Polytechnic, Oxford, Oxon., U.K. Guest of Honour—Ramsey Campbell. Registration £8 until 19 October 1990. Info: Conine 2, % Adrian Cox, St. John's College, Oxford OX1 3JP, U.K.

24-26 December
POLARCON 1990 (High Arctic SF conference) at The Workshop. This year's theme is "The effects of high-latitude ozone depletion on sleigh-drawn delivery systems." Contributors are requested to make out their lists well in advance.

25-27 January 1991
IMMACULATE CONFUSION (Michigan SF conference) at Southfield Days Hotel, Southfield, Mich. Guest of Honor—Esther M. Friesner, Artist Guest of Honor—Robin Wood, Fan Guest of Honor—S.P. Somtow, TM—Wendy Counsil. Registration—$18 until 1 December 1990, $22 thereafter and at the door (payable to AASFA/ConFusion): include date of birth with registration. Info: ConFusion, Box 8284, Ann Arbor MI 48107 (include S.A.S.E.).

15-17 Feb 1991
BOSKONE XXVIII (New England regional SF conference) at the Springfield Marriott and Sheraton Tara, Springfield, Mass. Guest of Honor—Mike Resnick, Official Artist—Emsh (Ed Emshwiller), Special Guest—Brian Thomsen (Questar Books). Registration—$28.00 until 11 January 1991, higher at the door. Info: Boskone XXVIII, Box G, MIT Branch, Cambridge MA 02139-0910.

29 August-2 September 1991
CHICON V (49th World Science Fiction Convention) at Hyatt Regency, Chicago, Ill. Guest of Honor—Hal Clement; Artist Guest of Honor—Richard Powers; Editor Guest of Honor—Martin H. Greenberg; Fan Guests of Honor—Jon & Joni Stopa. Registration—$95 until 31 December 1990. Supporting—$20 at all times. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Chicon V, Box 8121, Columbus OH 43221-8121.

8-14 September 1991
VOLGA-CON (International SF convention on the Volga). Sponsored by SF Club "The Winds of Time" and the Youth Association ATOM. Info: Volga-con, % Boris A. Zavgorodny, Volgograd-66, Poste restante, U.S.S.R. Telephones: 34-74-62, 34-74-64, 34-44-09, 34-86-56.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

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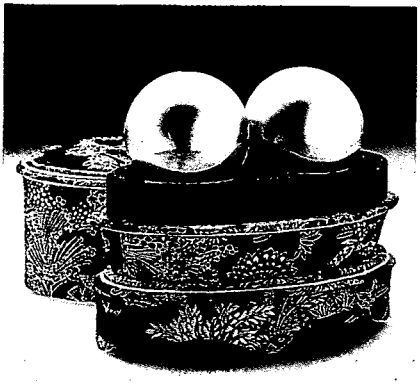

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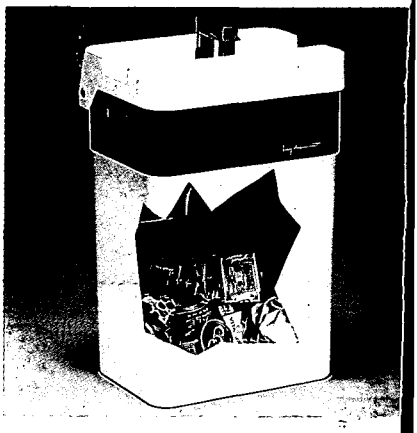

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